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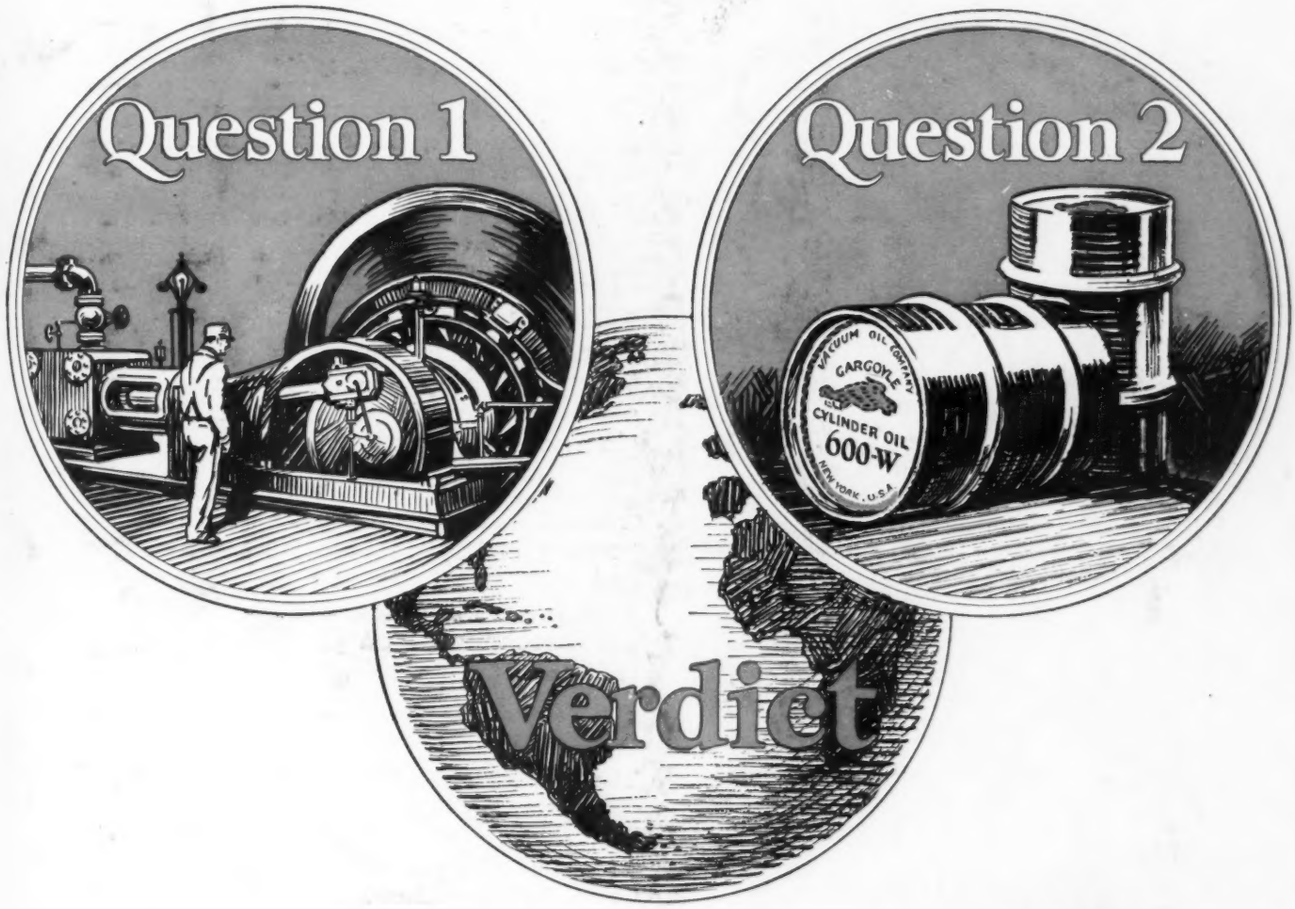

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Making Good Citizens Through Customer Ownership

ELECTION DAY fortunately has passed. It is a curious feature of our political life that candidates and parties will say things and do things which normally they would never think of saying or doing, if they feel it will insure their election. Moreover, general business seems to suffer from fright and hesitates to show any initiative in the face of an election, so that oftentimes the first Tuesday after the first Monday in November is dreaded rather than welcomed.

This year the so-called third party has sought to traffic in prejudice. It has attempted to array the "have nots" against the "haves" and has tried hard to spread the poison of bitterness. Fortunately, the electric light and power industry has for some years carried on a campaign of education which, while it has benefited that industry, has also been of great benefit to the nation.

By the sale of stock to employees and customers in small lots and on time payments the electric light and power companies of the country have brought about popular ownership of public utilities instead of political ownership; they have made investors and capitalists out of hundreds of thousands of men and women who previously had never invested a cent, and in the process they have made of them better and more dependable citizens. It is work of this kind that counts, and the more there is of it the less there will be of dissatisfaction in this country and the more rapidly will the demagogue find his occupation gone.

What the Income Tax Returns Reveal

THE publication of personal income taxes reveals the extent to which men of large means have withdrawn fortunes from productive industry and invested them in securities the income from which under our present laws is tax-exempt. That, of course, is their privilege, and so long as such inducements are offered by municipal, state and federal governments and surtaxes are so high, so long will large fortunes be invested in this way. Meanwhile enterprises which give men employment and help keep the country prosperous and contented must look elsewhere for needed funds. The situation is not without danger and no doubt must become worse before a remedy is forthcoming.

A government may grow rich and fat while its industries languish, and vast crowds of unemployed may receive doles from the government coffers; but without the sustenance which work and industry afford even governments became anemic. Government bonds are attractive enough without any tax-exempt clause, and no more tax-exempt bonds should be issued. However, there are millions of people in this country who believe otherwise, and it may be years before such an amendment to the constitution can be passed. Meanwhile some remedy is possible. If surtaxes are reduced, the inducement to rich men to flee to the repository to which all tax gatherers are forbidden entrance will not be so attractive and more of their wealth will find its way into productive business. The result will bring greater production, greater income and more widely distributed but none the less greater taxes.

Build for Permanence

A SALESMAN talked the other day with the manager of a small city power company. They were discussing material for line extensions and the salesman was arguing for permanent construction, a type of material that would endure for many years. The manager was for a less expensive equipment of acknowledged shorter life. "Why should I worry about what is going to happen years from now?" he said. "I shall be gone before that."

It is a natural thing for men to expect rapid evolution in the electrical industry. We have become accustomed to this attitude. But nevertheless wise men are building today for permanency, and those who specify and buy materials must remember that, though they themselves may have an expectancy of but a few years, the utility they serve is an enduring institution. A dam well built is as everlasting as the hills. It is for the public and the stockholders that they are intended, and there will be stockholders and a public when fifty years have rolled away. The era of rapid change in central-station practice is waning. This in itself makes for permanence. Executives must recognize the responsibility that comes with this and build well.

The Small Things That Have Aided Universality of Electric Service

WE ARE all inclined to pay attention to the development of the "largest steam turbine" or to a new 600,000-hp. steam generating station. We are captivated by the romance of harnessing huge water powers and of 220,000-volt transmission. We study figures of appliance sales and wonder at the immense growth of the use of electricity, frequently without effort on our own part. Yet how often is any thought given to the multitude of small things which, in the end, have been so effective in aiding the universality, the dependability, the economy of electric service? How much appreciation is there of the patient development behind numberless articles such as switches, fuses, sockets, small breakers, conduit fittings, to name only a few of those well known? Practically every piece of small equipment can be counted on for ser-

vice one hundred times out of one hundred. The element of standardization has been ever present in these lines too. Interchangeability of similar parts has become almost axiomatic and is looked back upon as a heavenly condition by Americans who stray to foreign parts where such standardization is conspicuous by its absence.

It is well to pause occasionally in the adoration of the stupendous to appreciate the smaller developments which have quietly gone hand in hand with the larger. After all, they are just as necessary. And that the work and thought necessary to bring them about have been forthcoming is another evidence of the high character of the electrical industry.

Fabrication of Structural Steel by Electric Arc Welding

ONE important conclusion brought out at the annual convention of the American Welding Society last week was that electric arc welding possesses undeniable possibilities of being utilized for fabricating structural steel parts in bridges, buildings, ships, etc., with economy and success. However, unless the welding engineer can clearly show in what respect fabricating by arc welding is superior to the present-day use of rivets, it is hardly to be expected that the latter method will be abandoned for a great many years to come.

The many advantages of welding for this work are well known to those who have been intimately associated with welding developments, and these men were somewhat surprised that other engineers outside the welding field did not understand these advantages and possibilities. The convention did a great deal of good in this respect inasmuch as it brought together the welding and structural steel engineers and those representing the steel and fabricating companies. The lively discussion showed that these interests were being brought together and that good co-operation between them would be brought about.

While a vast amount of information is already available, much more will have to be obtained, and, in particular, types of joints and shapes of structural members for welded structures will have to be developed in the light of welding experience and tests. Much attention, too, must be given to design, methods, inspection, workmen, materials and specifications.

A New Move Toward Uniformity in Inspection

IT IS not unusual for important movements to start in very unobtrusive ways. Nobody notices them particularly or considers them matters of interest until broadening influence begins to win a universal recognition. It is in such promising circumstances that the development of local code committees is proceeding under the leadership of A. Penn Denton of Kansas City, working under the auspices of the Association of Electragists International. It is taking the very simple form of bringing together the municipal inspector, the underwriters' inspector, a representative of the local contractors and the chief inspector of the central-station company as a committee whose function it is to effect a uniform local interpretation of the National Electrical Code. Such committees are now established in more than one hundred cities.

This is a matter of vital concern to all branches of the industry. From a national viewpoint, the formation of such local code committees offers hope of progress both toward code improvement and toward the uniform inspection standards in all states and cities that are so sorely needed and must come some day. They are sorely needed because the lack of uniformity in inspection requirements today is forcing the production of countless excess varieties in manufactured products. One city demands one type of safety switch, for example, while another city calls for something entirely different, although both are of the same size and used in the same service. There is a certain city where the jobber must carry the same size of safety switch in six special types to meet the ordinances of neighboring communities. And so it is in more or less degree with many other devices.

All this is a grievous burden on the electrical industry. It increases the cost of goods and the cost of service. It complicates both manufacture and distribution. It leads to conflict of opinion and to misunderstanding among electrical men. It sets central-station officials, contractors and inspectors at loggerheads upon many avoidable technicalities on many occasions. And it is this long-continuing condition that the local code committee is designed to relieve.

The idea of such a working unity between these four men in each community is so practical and so simple to carry through, it is no wonder that reports from many points indicate the successful working of the plan. The industry may well afford to watch this new expression of co-operation among electrical interests and to give it support and encouragement whenever possible, that these most desirable aims may be accomplished.

Showing the Way Toward Better Practice in Lighting

VERY largely, the basic principles of producing and controlling light for purposes of artificial illumination are known. How best to apply these principles to obtain the "lighting effect" desired—as a matter of fact, how to decide what "lighting effect" is desired—still presents problems to most people. Yet in this direction the Illuminating Engineering Society has made notable progress in recent years. And even in the direction of evaluating items heretofore believed not subject to evaluation, such as glare, definite accomplishment is shown. Witness the paper last week at Briarcliff Lodge by Luckiesh and Halladay on "Glare and Visibility."

What is most needed, therefore, is to spread the knowledge possessed by the Illuminating Engineering Society so that it may be put to greater practical use in the industry. President Law feels this need and voiced it strongly in his presidential address—pointing out that steps more definite than in the past should be taken to educate the rest of the electrical industry to the use of best methods of lighting and in the consequent economical possibilities.

Lighting is still the great significant use of electricity, though in many places the employment of electrical energy for power purposes is greater than its use for light. Lighting is also a profitable business, and additional lighting load on existing lines is still more profitable. It is hard, therefore, to understand why so little attention is paid by some companies to the subject of selling more and better lighting. With the impetus now given by the lighting educational contest, how-

ever, there should be a reawakening on the part of central-station executives to the opportunities; and there should thus be increased need for the Illuminating Engineering Society to show the way to better lighting practice.

The Success of the N. E. L. A.-I. E. S. Lighting Course

A VERY practical demonstration of how to transfer the knowledge and experience of the illuminating engineer to his confrère, the central-station commercial lighting manager, has been the N. E. L. A.-I. E. S. lighting course just completed. For several weeks past a group of central-station lighting men coming from cities as widely separated as Los Angeles and Boston, as Atlanta, Montreal and Toronto, have been taking this course given by the I. E. S. under the joint sponsorship of the N. E. L. A. and the I. E. S. Not only have these men studied lighting principles and the theory of lighting practice, but they have been taken to Cleveland, Chicago, Washington, New York, Boston and elsewhere, where they have studied lighting practice in the field. They have done this with illuminating engineers at their elbows to answer their questions, to separate good practice from bad and tell why, and to point out commercial possibilities.

These men have finished this course with emphatic statements as to its practical value to them individually and thus to their companies. They go back home equipped with both knowledge and enthusiasm to develop better lighting practice in their communities and consequently better lighting loads for their companies.

Evaluating the Possibilities of Hydro-Electric Projects

THE economic development of a hydro-electric project should be predicated on complete data, but these data are difficult to obtain in many cases. The article by Robert Ewald and the letter by Clemens Herschel in this issue indicate methods for evaluating the power possibilities from the hydraulic standpoint. Mr. Herschel uses an average river-flow duration curve and advocates the installation of prime-mover capacity based on the "year's midday" as given by the curve and a restricted gate opening determined by specific conditions. The method must be used with judgment, for it is based on averages, and in many cases minimum and maximum year duration flow curves as well as those of intermediate flow years should be plotted and studied very carefully. In addition, the kind, amount and quality of load available for using the power produced will modify the value of prime-mover capacity to be installed.

To add to the difficulty of accurately gaging a river flow, water storage usually enters into the problem, and Mr. Ewald has outlined a very convenient method for projects of this character. He combines stored-energy and actual stream-flow curves and evaluates each head and flow condition as to their power possibilities. While averages are not dealt with in plotting these data, it is necessary to use averages and good judgment at the stage where the actual prime-mover capacity for a given project is to be determined, and here also the kind, amount and quality of load available must be considered.

Possibilities of Fuel Conservation Are Encouraging

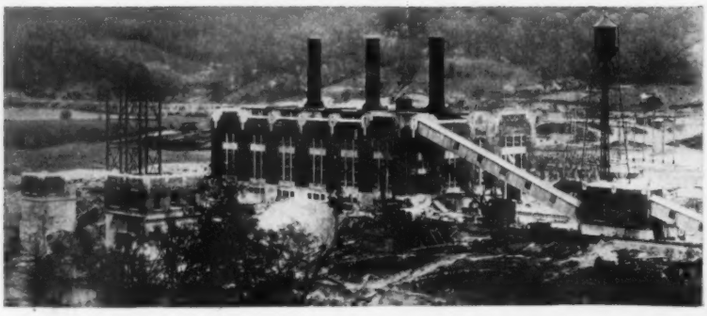
BURNING coal in large stations containing large units has resulted in the production of electric power at a thermal efficiency of around 25 per cent. This achievement of the electrical industry has been a noteworthy contribution to the cause of fuel conservation, and yet the loss of three tons of coal out of four sets a desirable goal for further gains in efficiency.

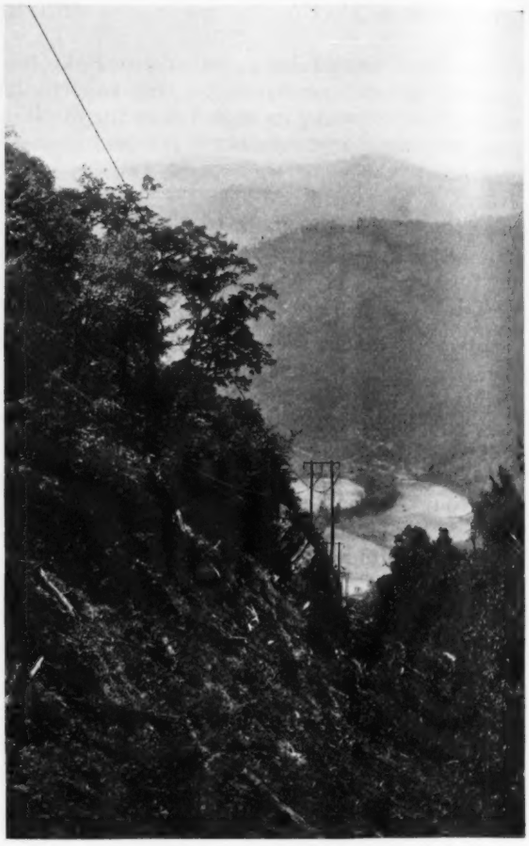
Even with the present departures in large boiler and turbine design, however, it seems impossible, because of the inherent losses involved, to achieve a very great advance in efficiency in the present process of burning coal to produce electric power. Thus in order to utilize even two tons of coal out of four very radical departures in fuel burning and in power production will be necessary. Many efforts are being made experimentally to utilize coal with greater economy. The use of by-product plants in conjunction with power stations burning coke or pulverized fuel offers attractive thermal efficiency possibilities but introduces economic and operating handicaps of great magnitude. These same conditions exist when attempts are made to increase efficiency by using two vapors in series to increase the temperature range, although the future of the mercury-vapor steam-power plant is very promising.

In a short time positive economic and operating data should be available on installations embodying these principles, but there remains one field of activity in industrial and metropolitan areas which should be thoroughly investigated from both an engineering and an economic standpoint.

The present trend in these areas is to concentrate electric power production in a few very large stations in order to reduce the investment cost per unit of capacity and in order to obtain the economies possible with bulk production and to use locations having a suitable amount of circulating water. This trend or practice should be considered in comparison with a very different procedure involving the use of multiple stations for producing both electric power and low-pressure steam for heating and process applications. These unit stations might well contain one or two very large prime movers in order to reduce investments, and the low-pressure exhaust steam used commercially would eliminate the necessity for the use of large amounts of circulating water. Another attractive feature of the proposal would be the entire elimination of private plants and residence-heating plants with their low thermal efficiency. As against the attractive thermal and economic features there are many economic and operating handicaps which must be considered. Past experience in central heating plants has not been very satisfactory, and even though conditions may have changed, there are many objections to combining electric power and steam heating as a commercial enterprise. The point is that the advantages and disadvantages should receive careful consideration under present-day conditions.

Any move that will increase the efficiency of coal utilization should be encouraged, for even though central stations use only about 8 per cent of the total coal consumed and there remains a vast reservoir of coal in the earth, the facts remain that coal increases in price yearly, and that no national resource should be wasted. Better efficiency generally means better and cheaper service.





New Developments in Kentucky

NEW power stations and new interconnections are features of developments in eastern Kentucky. A view is shown here of the new 30,000-kw. Pineville station of the Kentucky Utilities Company, and other views show 66,000-volt lines in the vicinity of Pineville. These lines traverse a rough and mountainous country and several long spans were used.

The station is tied in with the Pocket (Va.) plant of the Electric Transmission Company of Virginia and through this system with the plant and system of the Old Dominion Power Company at Norton, Va. A 95-mile, 66,000-volt tie line is installed between the Pineville plant and the High Bridge hydro-electric plant on the Dix River owned by the Kentucky Hydro-Electric Company. Upon completion of the hydro-electric plant the Pineville station will operate under a base load and the hydro plant will take the load fluctuations. The Dix River project will have an installation of 30,000 hp. and a storage of 24,000,000 kw.-hr. The Kentucky Hydro-Electric Company is building a double-circuit 66,000-volt line from High Bridge to Lexington and Louisville.

Substation Design to Meet Space Limits

Unusual Conditions on Southern California Edison System Lead to Innovations in Plans—Transformer Cooling Coils Are Placed on Roof of Building—Special Arrangement of Equipment Necessary

By J. C. GAYLORD
Engineering Department, Southern California Edison Company, Los Angeles, Cal.

TO DESIGN a substation with an initial capacity of 6,000 kva. and an ultimate capacity of 12,000 kva. which would house two transformer banks, feeder regulators, control and auxiliary equipment, and yet allow the building to stand on a lot 25 ft. by 50 ft. in dimensions, was a problem which has been solved by the Southern California Edison Company. All lines were to enter the station underground, and, on account of the location of the station making noise undesirable, it was necessary to place the transformers, regulators, pumps, etc., in the basement. These specifications, together with the limited space available, made the job difficult, especially for a Western designing engineer, who is not ordinarily so cramped for space. It was also difficult from the construction point of view because there was little space available near the site for storage of material for the project.

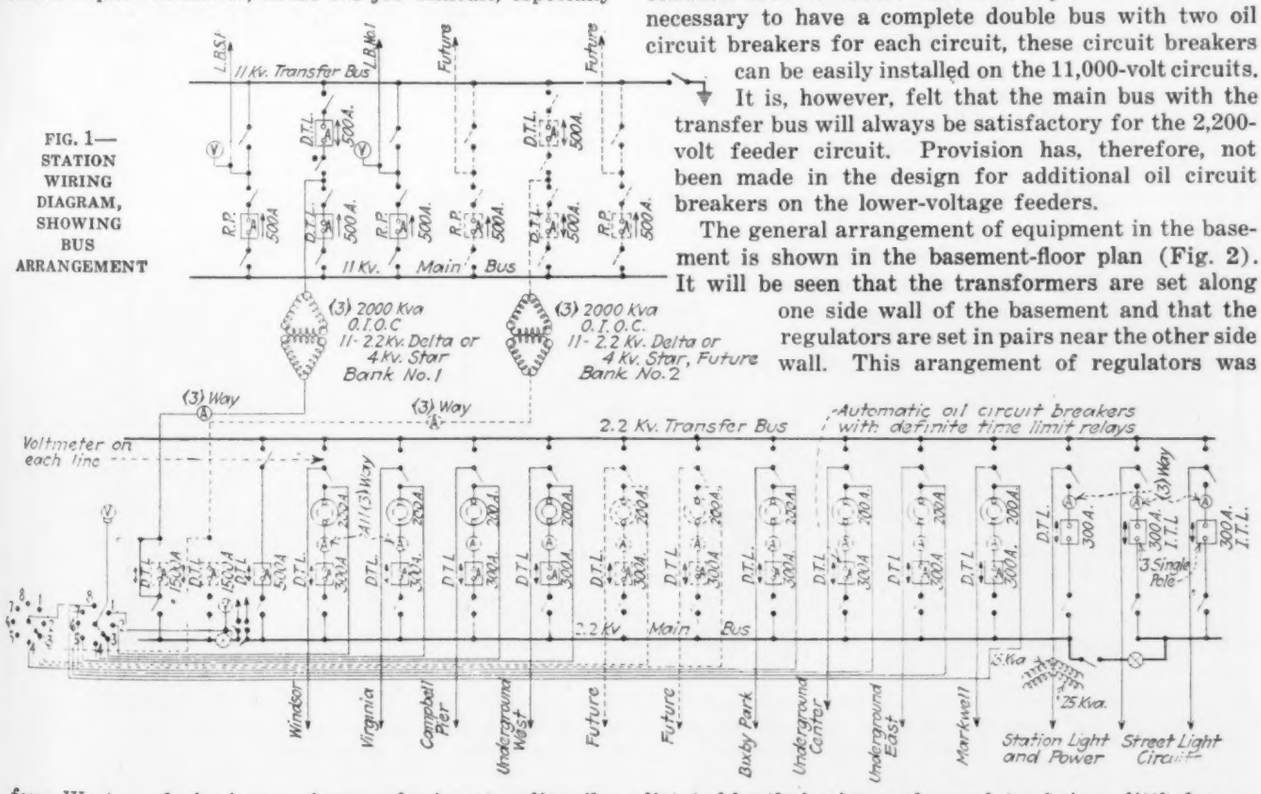


FIG. 1—STATION WIRING DIAGRAM, SHOWING BUS ARRANGEMENT

After preliminary study it was decided to build a three-story station with the transformers and regulators in the basement, the feeder switching equipment and the instrument and control board on the main floor, and the 11-kv. switching equipment and storage battery on the floor above. In order to avoid the disagreeable and more or less noisy features of a water circulating and cooling system, transformers and regulators of the self-cooled type were selected.

As shown in the single-line wiring diagram (Fig. 1), the station is arranged with a main bus and transfer bus for each voltage. The main source of energy is an 11,000-volt line direct from the Long Beach steam plant. This line is "looped through" the new Pine Avenue substation, as it is called, and continues on to another substation in Long Beach, whence it completes the loop back to the steam plant. For the present the station will be operated as a single-bus station, the transfer buses being used only when it is necessary to inspect or repair an oil circuit breaker or regulator. The station, however, is so designed and all control conduits are so installed that if at any time it is deemed necessary to have a complete double bus with two oil circuit breakers for each circuit, these circuit breakers can be easily installed on the 11,000-volt circuits.

It is, however, felt that the main bus with the transfer bus will always be satisfactory for the 2,200-volt feeder circuit. Provision has, therefore, not been made in the design for additional oil circuit breakers on the lower-voltage feeders.

The general arrangement of equipment in the basement is shown in the basement-floor plan (Fig. 2). It will be seen that the transformers are set along one side wall of the basement and that the regulators are set in pairs near the other side wall. This arangement of regulators was dictated by their size, each regulator being a little larger in diameter than the space, lengthwise of the room, allowed for each circuit. The arrangement also has the advantage of giving a slightly better circulation of air about each regulator. In one corner of the basement will be seen a transformer oil tank and in another corner a spiral stairway running from the basement to the roof with a landing at each floor. There is also another exit from the basement and either of the other floors of the station by means of a ladder on the end wall opposite the spiral stairs. Oil pumps, etc., are installed in the basement between the oil tank and the spiral stairway.

There is nothing of special interest in the arrangement of equipment on the main floor. On the second

floor, as shown in the second-floor plan (Fig. 3), the battery is completely partitioned off from the other equipment, and in the battery room is a lead-lined sink for use in battery maintenance.

The 11,000-volt switches on the second floor are installed each in its own cell, and, as noted above, cells are provided so that each circuit may have a circuit breaker to each bus, when the double-bus arrangement becomes necessary. The radiators for cooling the transformers are on the roof, as is also a small closed oil tank.

The station building is of fireproof reinforced-concrete construction throughout. The main floor was made about the height of a low truck above the alley grade so as to facilitate loading and unloading equipment and also to prevent water from running in on the floor and into the basement. There is a 7-ft. square hatch in the main floor near the main entrance to the station, over which there is a large beam and chain hoist for lowering equipment into the basement. There is also a small hatch in the second floor through which equipment for that floor can be raised.

Referring to the wiring diagram of Fig. 1, each circuit breaker is automatic, as indicated by the *A* within the circuit-breaker symbol. The circuit breakers on the two 11,000-volt lines are made automatic with induction-type directional relays so set that should a short circuit occur on either side of the station that section of the line would be immediately cut out without in any way interrupting the supply of power to the station, which would be furnished from the other line.

The circuit breaker through which the transformers are supplied from the main bus is equipped with induction-type overload relays having a definite minimum time setting. The circuit breaker connecting the transformers to the transfer bus is also equipped with definite minimum-time-limit induction-type relays. This circuit breaker, as may be noted from the wiring diagram, may be connected by the use of selector switches so as to be substituted for any of the circuit breakers on the main bus. However, when it is substituted for either of the line circuit breakers the directional element of protection of that line is lost. It is felt that this sacrifice of directional protection will not prove a serious disadvantage because it will be necessary to use the transfer circuit breaker only for short periods while inspecting or repairing one of the other breakers.

Until such time as the second bank of transformers is installed there will be no oil circuit breaker on the low-voltage side of the transformer bank. When the second bank is installed an automatic breaker equipped with definite time-limit relays will be put in for each transformer bank.

Each of the 2,200-volt feeder circuits, as well as the 2,200-volt transfer bus, is controlled by an oil circuit breaker equipped with definite minimum-time-limit induction-type relays. In case it is necessary for any reason to inspect either the regulator or the circuit

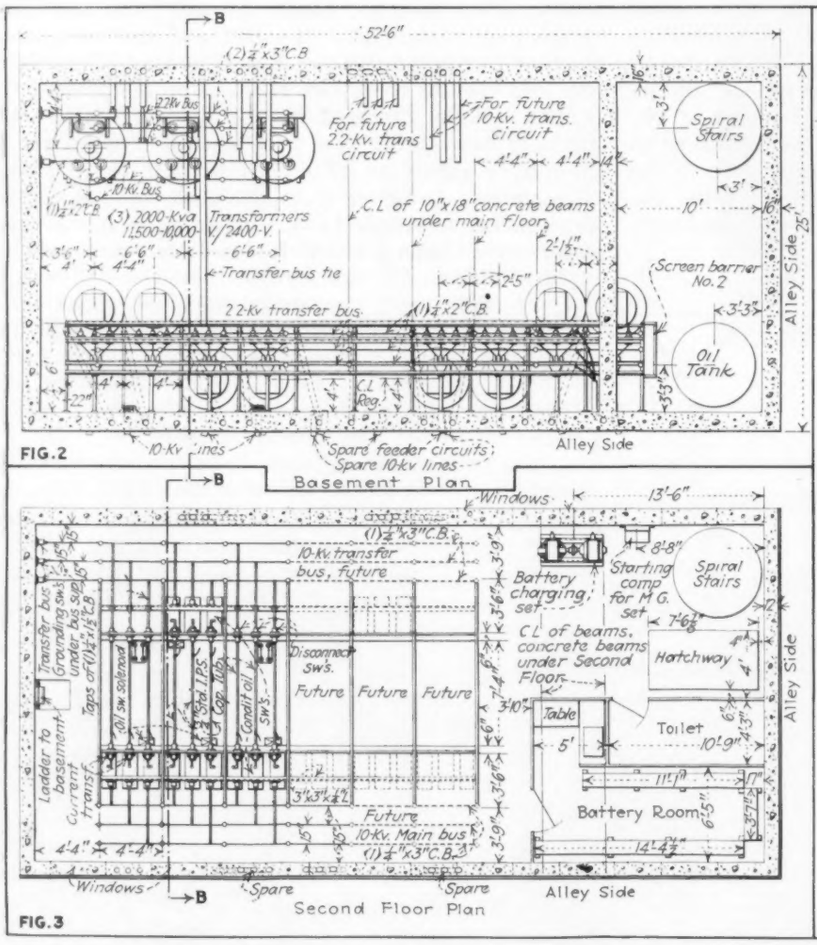
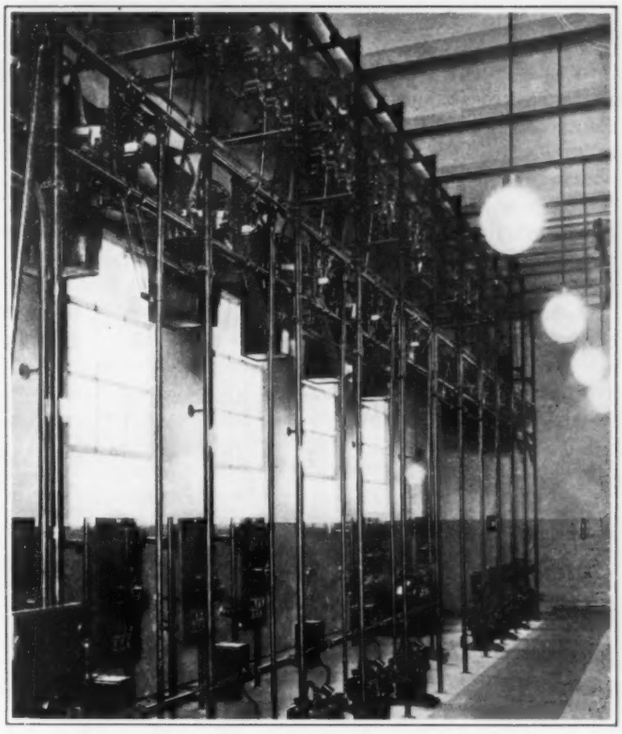


FIG. 2—BASEMENT FLOOR PLAN, SHOWING LOCATION OF EQUIPMENT. FIG. 3—SECOND-FLOOR PLAN.
FIG. 4—TRANSVERSE SECTIONAL VIEW OF BUILDING AND EQUIPMENT

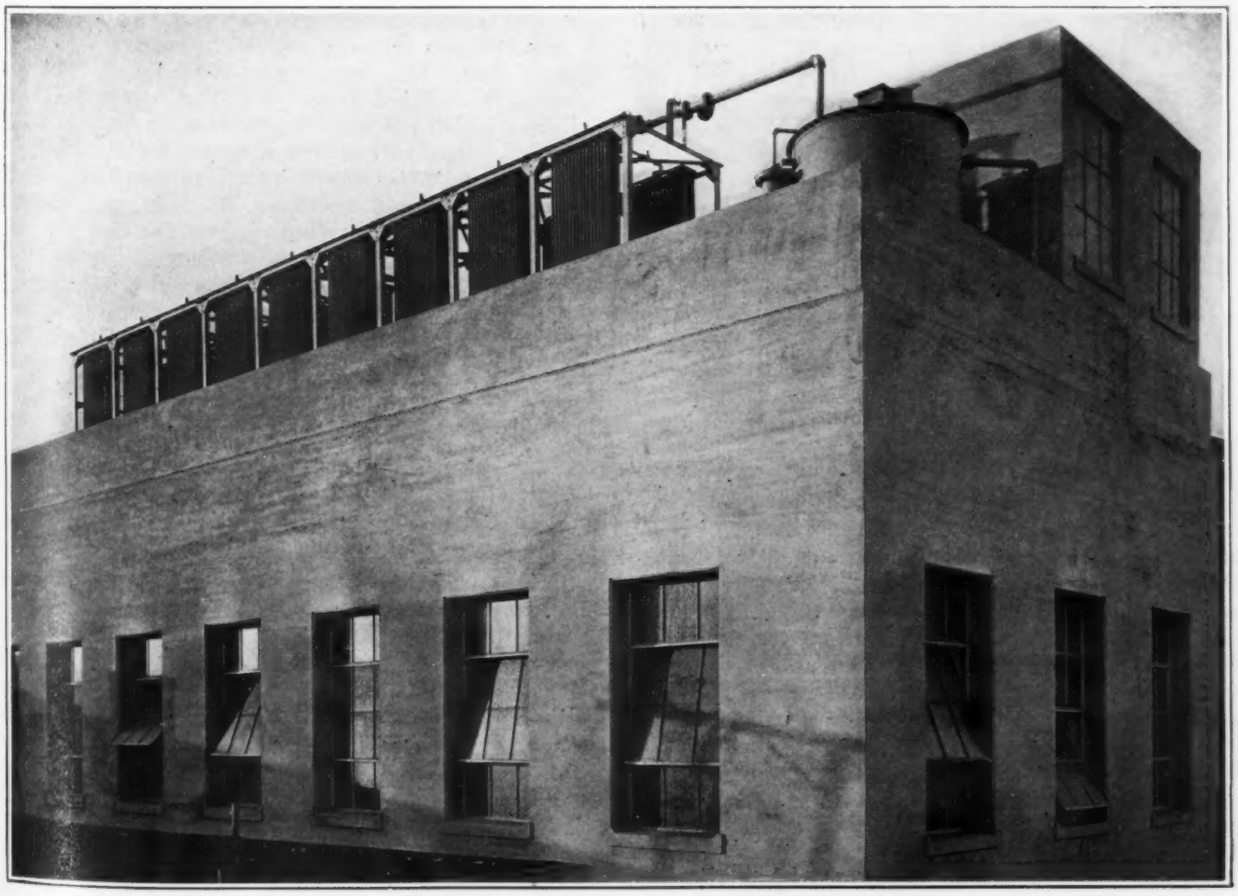
breaker on any of these feeders, the feeder is switched to the transfer bus by means of double-throw disconnecting switches and the breaker and regulator are cut out of service. This changeover to the transfer bus is made with double-throw switches to prevent the possibility of short-circuiting the secondary voltage of the regulator, as might be done if two sets of single-throw disconnecting switches were used. The 2,200-kv. transfer bus, as shown in the wiring diagram, is supplied directly from the main bus through a circuit breaker of its own. This scheme is somewhat different from the one used on the 11,000-volt bus, being not quite so economical of space but having some advantages over the other plan.

The station light and power circuit is similar to the feeder circuits, except that it is not equipped with a regulator. The street-lighting circuits are supplied from a section of the main bus so arranged that they are metered in a group separately from the rest of the station output. All circuit breakers are electrically operated with 125-volt direct current supplied from a motor-generator set supplemented by a 125-volt storage battery. All circuit breakers are controlled from the instrument and control switchboard installed in a room on the main floor.

Each of the incoming 11,000-volt lines is equipped with a voltmeter, which is used more for detecting a hot line than for the value of voltage readings. The transformer bank is equipped with a single ammeter and a three-way ammeter switch for taking current readings on each leg of the transformer circuit. Each 2,200-volt feeder circuit is also equipped with an ammeter, a three-way switch and a voltmeter. There is a recording voltmeter so arranged that it may be connected to any feeder circuit or to the unregulated bus. A watt-hour meter is connected in the main bus in such a way as to record the total watt-hour output of



ELECTRICAL EQUIPMENT ON 2,200-VOLT CIRCUITS



EXTERIOR OF STATION, SHOWING OIL-COOLING COILS ON THE ROOF

the station. Test switches are installed in the main bus so that test meters may be connected and switched into the circuit without interrupting service. These switches are so arranged that the test meters may be connected without it being necessary for the test man to make any hot connections. The station light and power circuit is metered on the secondary side.

There is an alarm system arranged to call the operator's attention to any circuit breakers that may trip out, to a ground on any circuit or to high or low oil level.

Enough air is circulated through the basement to take care of cooling the induction-type regulators. It was considered impracticable to circulate enough air through the basement to cool both banks of transformers as well as the regulators, and it was therefore decided that the radiators should be removed from the self-cooled transformers, placed on the roof and connected to the transformers through the necessary oil circulating system. A diagram of this system is shown in Fig. 5. Pumps were installed to insure circulation of the oil, and tanks, float valves, etc., were installed so that the oil pressure in the transformer tanks in the basement would not be great enough to cause the tanks to leak.

Following the arrows in Fig. 5, it will be seen that the hot oil flows from the transformers to the suction side of the pumps. From the pumps it is forced to the roof and through the cooling radiators. From the radiators the cooled oil flows freely into a closed tank on the roof, this tank being provided with a large breather to keep moisture from getting into the oil. Thence it flows back to the basement into the upper part of a double tank, through a 2-in. float valve, as indicated on the diagram. This valve tends to keep the oil at a constant level in this part of the tank. From this tank it flows back to the transformers.

By manipulation of the valves any transformer tank may be drained into the lower part of the basement oil tank. There is a 5-in. overflow from the upper part of this tank to the lower part, and there is also a 1-in. vent between the two parts of the tank to equalize the air pressure. The overflow from the roof tank runs into the lower basement tank. From the lower tank the oil may be taken out and filtered or may be pumped back into the system. A high-oil-level alarm gives the operator notice if the system is not working properly. A pump is provided for each transformer bank and a spare pump is provided which may be put into use in place of either pump which may be out of service.

So far the cooling system has given entire satisfaction, and the operation of the station as a whole has also been very satisfactory.

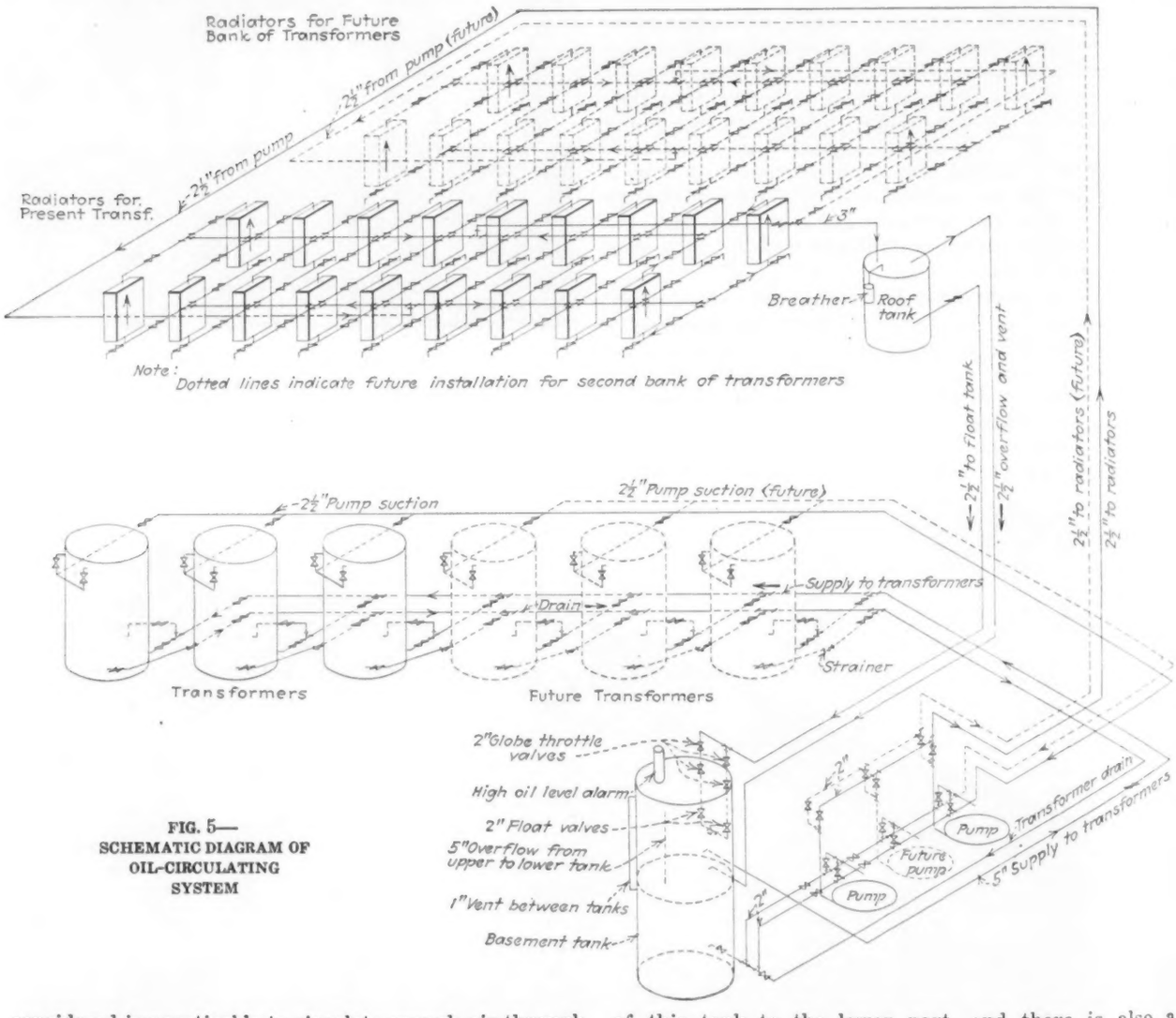


FIG. 5—
SCHEMATIC DIAGRAM OF OIL-CIRCULATING SYSTEM

Power Rates in Hydro Development

Economic Limits of Development of Water Power Are Fixed by the Maximum Rates for Various Periods — Computations by Means of "Energy Draw-Down Diagrams" Explained

By ROBERT F. EWALD
Pittsburgh, Pa.

IN DETERMINING the economic limits of development of a water-power proposition it is necessary to ascertain the maximum power rates that can be maintained for various percentages of time. In propositions involving a system of large storage reservoirs operating under widely varying heads and rates of discharge and with water carried in long conduits the actual determination of the correct rates is far from being a simple matter. Usually a number of estimates involving variations in capacity of reservoirs and conduits are required, and the determination of the concomitant power rates for each of the various combinations becomes a formidable task.

Several years ago the writer was called upon to estimate the power available from a proposed development in the West in which storage could be used to almost any practical limit of dam construction. Several years of record of stream flow were available. The water was to be used through a number of plants. Tunnels of considerable length, and therefore very costly, were involved. Furthermore, the development would be tied in with others. The determination of the economic limit of development became quite an involved matter, the more so since the long tunnels and widely varying levels of water in the reservoir involved wide variations in head on turbines, in addition to the variation in flow injected into the problem by nature. In attacking and solving the problem a set of diagrams was devised and used to considerable advantage. Since that time other methods employed for the same purpose have been observed, but as yet nothing quite as simple or more broadly applicable. To a type of diagram for similar purpose, devised by B. F. Groat but of entirely different form, he gave the name "energy draw-down diagram," and as it appears that this term can be well applied to all diagrams of that type, the liberty has been taken of using that name in the form under consideration.

A specimen of an energy draw-down diagram employed in estimating the power available from a proposed system of hydro-electric developments in the South is presented herewith, together with a discussion of the method of making up and using.

The power development for which the diagram was made involved the construction of a dam forming a huge storage lake at a point on a small river above which the drainage area was 175 square miles. The water was to be conducted through a tunnel 4 miles long, through a power house (called Sanford) into the forebay pond of another power house already completed (called Chotah). Downstream from the Chotah development a third power house (called Caledonia) was to be built at some future time. Site conditions were such that the storage dam could be built to a height of 200 ft. Twenty-five years of stream flow records were available. Among the problems to be solved were the economic limit of height for the storage dam and the proper size of tunnel considering the Sanford, Chotah and Caledonia developments as a unit. This involved the accurate determination of power rates for several combinations of reservoirs and tunnel sizes. The same information was also required for conditions assuming that the Caledonia development would never be built.

From the storage curve for Sanford reservoir the storage in cubic feet between each 5-ft. level was determined, and each of these quanities, multiplied by the height of the center of that prism above the tailwater level of the lowest development (Caledonia), gave a quantity which was a measure of the potential energy of that prism. For convenience this quantity, "cubic feet multiplied by height in feet," is called "quartic feet" (a term also first used by Mr. Groat in so far as the writer is aware). Beginning at the lowest elevation the storage reservoir to which the water could be drawn down, the amounts of energy in storage in each 5-ft. lever were successively summed up and the sums plotted on the diagram, using water-surface elevations as *Y* ordinates. The curve through these points is labeled "stored-energy curve." For convenience the curve was broken up into short lengths placed one above the other. The figures on the *X* ordinates adjacent to each section of the curve show the values assigned to the *X* ordinates for that particular section of curve.

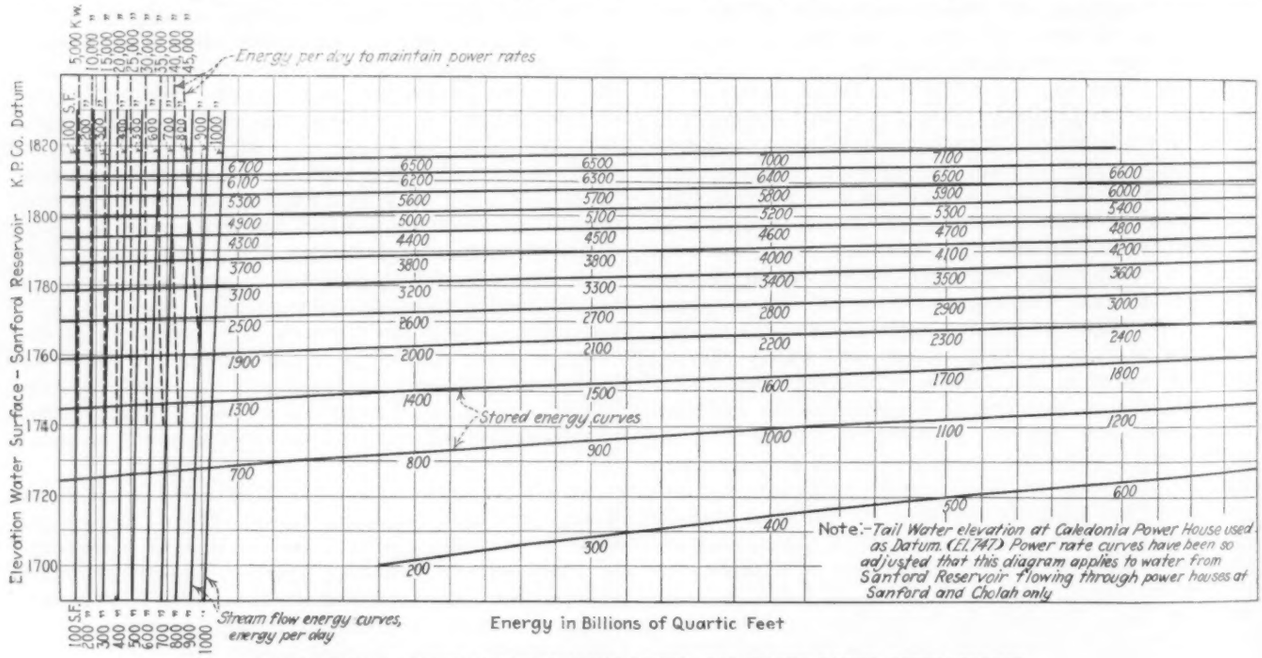
At water-surface elevation 1,720 (the limit drawdown) the total potential energy above datum 747, which is the tailrace level of the lowest plant (Caledonia) in which we are interested, amounts to 520,000,000,000 quartic feet. At water-surface elevation 1,800 the total energy in storage is 4,920,000,000,000 quartic feet. The computation of the "energy in storage" curve is very simple and accomplished with great facility with adding machines.

STREAM-FLOW ENERGY CURVES

Another system of lines designated as "stream-flow energy curves" show the number of billion quartic feet entering storage per day for definite rates of stream flow in cubic feet per second. Thus, with the water surface at 1,800, a discharge of 1,000 cu.ft. per second would add 90,800,000,000 quartic feet per day. For the same rate of flow at elevation 1,720 the energy added would be 83,000,000,000 quartic feet. The computation and drawing of these lines is also a very simple matter and completed in a few minutes.

In the particular problems studied the "stored-energy curves" and "stream-flow energy" curves were plotted on cross-section tracing cloth and a set of black-line prints made on white paper. To each of these white prints a third set of curves (shown by dashed lines) was added, showing the energy required per day to maintain cer-

tain uniform power rates. The computation of these curves is somewhat more laborious and a new set is required for each change in structural conditions. This is the reason for making several white prints for a base, as a new diagram can be made up for each set of conditions, the power-rate curves being the only curves changed. In computing the amount of stored energy required to maintain any assigned power rate it is necessary, of course, to take into consideration all losses in head involved in hydraulic, mechanical and electrical friction and in the failure to utilize any portion of the total static head for which the stored-energy and stream-flow-energy curves were computed. Thus, in the diagram shown, the stored-energy and steam-flow-energy curves were computed to show the potentialities of the full fall from elevation 1,820 down to 747. For the particular set of conditions now under consideration it is assumed that the portion of the fall between elevations 960 and 747 (the Caledonia development) will not be developed, so this gap is treated as a loss of head and added to all mechanical, electrical and hydraulic losses. Obviously, then, using a definite example, if 70,000,000,000 quartic feet per day are required to maintain a 10,000-kw. rate without losses of any kind, but actually all losses of head, including hydraulic, mechanical and electrical friction losses and failure to utilize available head, amount to X per cent of the total static head, the actual number of billion quartic feet required is 70 (theoretically) $\div$ $(100 - X)/100$. The quartic feet actually required were computed in this manner for power rates varying by steps of 5,000 kw. and for reservoir elevations varying by 20 ft., careful consideration of all losses being given for each set of conditions. The curve for each power rate was then plotted on the diagram in dashed lines.


Energy per day to maintain power rates
Elevation Water Surface - Sanford Reservoir K.P.Co. Datum
1820
1800
1780
1760
1740
1720
1700
Stored energy curves
Stream flow energy curves, energy per day
Energy in Billions of Quartic Feet
Note:-Tail Water elevation at Caledonia Power House used as Datum. (EL.747) Power rate curves have been so adjusted that this diagram applies to water from Sanford Reservoir flowing through power houses at Sanford and Chotah only

GRAPH USED TO DETERMINE ECONOMIC LIMITS FOR WATER-POWER DEVELOPMENT

TYPICAL EXAMPLES

A few concrete examples will now be discussed to illustrate the application of the diagram.

1. With water surface in reservoir at 1,800 and an average daily stream-flow of 800 second-feet, the stream-flow energy curves coincide with the 45,000-kw. line at elevation 1,800. This means that the flow of 800 second-feet through the Sanford and Chotah power houses is just enough to maintain that power rate and no energy is stored or taken out, so no change in lake level ensues.

2. Now assume that there is maintained a 45,000-kw. rate and that the stream flow is only 300 second-feet. The horizontal distance between the intersections of the 45,000-kw. line and the 300-second-feet line measured along the elevation 1,800 line is a direct measure of the amount of energy required to be taken out of storage, and upon measuring this distance to the left, beginning with the intersection of the stored-energy curve and the 1,800 line, it is found that the new elevation is 1799.4. Had the stream flow been greater than 800 second-feet, the measurement would have been made to the right of the point of intersection.

With (1) such a diagram, (2) the United States Geological Survey records' daily discharge sheets and (3) a pair of dividers, the exact position of water-surface elevation at any time can be readily determined mechanically and the exact performance of the reservoir with any given power rate over a long term of years determined with facility. The dividers are used for stepping off the excess or deficiencies between actual stream flow and the flow required to maintain the selected power rate, the position of the fluctuating reservoir at definite time intervals being noted on another diagram. The writer finds that with a little practice twenty years of records can be covered in two days, with the assurance that the results are as nearly correct as can be had.

A variety of changes may be incorporated into the diagram, facilitating computations to cover changes in structural layouts or in details of operation. Double letter-size ruled papers in which horizontal ordinates represent months, each sheet covering ten years of record, form convenient forms upon which to record the power rates tried and the resultant reservoir elevations and water flow required to maintain the given power rates. These diagrammed records will then form a

series of powergraphs. A series of these powergraphs, covering a variety of conditions with regard to reservoir and conduit capacity when based on twenty or thirty years' record of stream flow, will usually present to the uninitiated engineer in convincing form the importance of storage and of conserving head in water-power developments.

In a number of propositions where similar energy draw-down diagrams have been used definite rules of procedure in handling large reservoirs have been determined with relative ease. Such rules, based on past experience, state that it will be safe to continue certain power rates until a certain water level is reached; then a lower rate is used until a second specified stage is reached, and so on. With such rules for operation it is possible to utilize the reservoir to the economic limit without danger of a complete draw-down before beginning a period of low flow.

Many engineers make their power estimates by the aid of hydrographs. These require an immense amount of labor to prepare and fail to show the most important variable, the head, making it necessary to make additional calculations to obtain the desired data. Other engineers use so-called average duration curves. It is almost certain that power rates based on such curves will be far from the truth, as power rates based on average curves will suffer many more interruptions under actual operating conditions than will be permissible. The duration curve for a minimum year is not satisfactory for determining the economic limit and for a maximum year means nothing at all. Duration curves are worthless for determining storage where variable heads are involved; they give no picture of what actually may be expected during a long period of years, nor do they facilitate determination of those changes in handling of reservoirs that may lead to increased production of salable power.

Only a short time ago the writer reviewed the determinations of the power rates for a system of plants using two large reservoirs, the determinations having been based on twenty-five years of record, using monthly average flows—a very common practice. Upon checking over the determination, using an energy draw-down diagram, it was found that the actual minimum rate that could be used had been overestimated nearly 20 per cent and had such a rate been actually attempted, on an average in one year in four, in attempting to maintain the suggested rate, the system would have been faced with dry reservoirs much earlier than anticipated and would then have had to drop to power rates perhaps not over 50 per cent of the predicted minimum. The effect on firm power contracts can be imagined.

Diesel Engine Operating Experience

How the Installation of Two 550-Hp. Units of the Type Named Saved Neodesha, Kan., $18,624 in Ten Months—Analysis of Operating Results—Details of Installation

By J. A. BOGGS
Superintendent of Power, Neodesha, Kan.

DESPITE the continued extension of central-station transmission lines and improved operating economy, there still are many municipalities that cling, however mistakenly, to the idea that better service can be rendered by a municipal power plant. Some of the more progressive of such communities realize that most of their past generating equipment has been inadequate and are casting around for better means of power production. In the past it has been the feeling in such places that with the resources of the municipality back of the investment such substantial returns need not be shown as if the plant had been privately owned. The prevalent belief is that with proper equipment power and lighting service can be furnished as cheaply by the municipality as by private interests, but in order to operate on a profitable basis citizens realize that the power generating equipment must be efficient and modern.

Such was the sentiment existing at Neodesha, a city of 4,500, in southern Kansas, before the installation of two 550-hp. Nordberg two-cycle Diesel engines directly connected to a 375-kw. generator. Like other municipalities, the power plant was the outgrowth of the water system, which had its beginning with a small pumping station purchased from a local oil refinery. The demand for electric service later arose, so that an additional boiler and a 125-kw. generator were installed which were driven by a high-speed four-valve engine. The load gradually increased until it became necessary to install more generating capacity. The boiler plant was then enlarged and a simple Corliss engine installed, directly connected to a 250-kw. generator. At the time of installation these units were efficient and suitable for the requirements. But during the last few years it was common knowledge that the plant was being operated

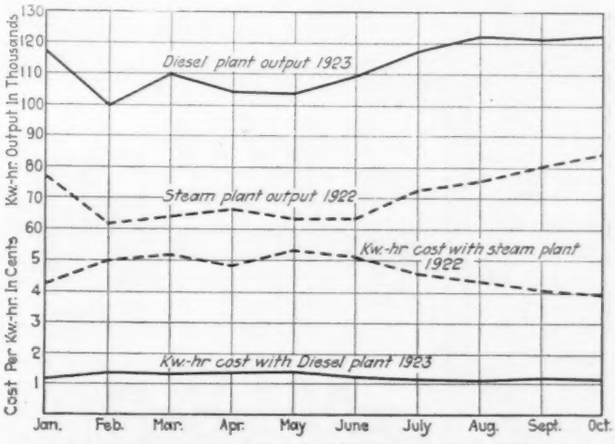


FIG. 1—THESE TWO DIESELS HAVE PRODUCED A SAVING OF 56.8 PER CENT OVER THE OLD STEAM-PLANT OPERATION

for service and not for profit. Even though every effort was made to give profitable service, the inefficiency of the existing equipment precluded the attainment of the desired results. On comparing the cost at which power was being produced with that being obtained in modern installations it was evident that some decided action must be taken if the plant was to serve as a municipal asset.

WHY DIESELS WERE SELECTED

The municipality was fortunate in having a number of broad-minded citizens who saw the value to the community of having a good municipal plant which would give real service and at the same time return a reasonable profit. A way out through purchasing energy from a utility company was considered, and it was decided that before any decision was made careful analysis of the municipal utilities problem should be made. Accordingly, Black & Veatch, consulting engineers of Kansas City, were engaged.

For some years past it had been evident that the natural-gas supply available for boiler fuel was diminishing. Furthermore, the price had increased from 15 to 25 cents per 1,000 cu.ft. This necessitated the choice of a more efficient form of power. Three types of units were suggested—steam turbines, uniflow engines and Diesel engines. Owing, however, to the constantly increasing cost of fuel and an insufficient supply of suitable condensing water, a condition which would seriously affect the efficiency of a turbine during the summer months, little consideration was actually given to that type of unit. A number of steam and Diesel-engine plants were visited and the merits of each form of power carefully weighed. During the entire deliberations the Mayor practically stood alone for the Diesel installation. As a result of these investigations two 550-hp. Nordberg Diesel engines were installed (Fig. 5). The engines were placed in service in November, 1922, and since then one or the other has been in continuous operation.

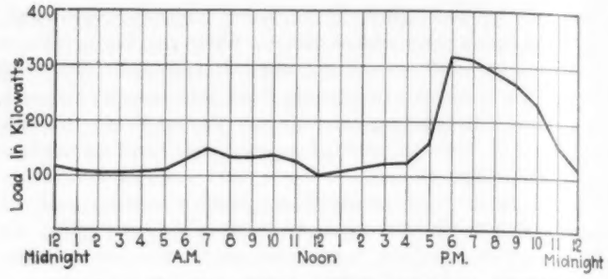


FIG. 2—A TYPICAL LOAD CURVE YIELDING AN AVERAGE OF 155 KW.

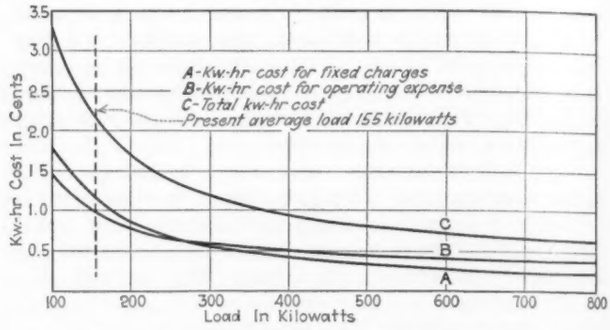


FIG. 3—WHAT A DIFFERENCE IN LOAD FACTOR WILL DO IN DECREASING KILOWATT-HOUR COST

To finance the purchase of these engines, and also for improvement and extension of the lighting and water systems, a total bond issue of $195,000 was floated, of which $153,600 was chargeable to the Diesel plant. Although this was a large bonded indebtedness to place on the city, a careful estimate made by the consulting engineers regarding the available profit from operation has been closely checked with the income of the first ten months of service.

A comparison of costs taken from the records of the steam plant for the ten months of 1922 with a corresponding period for the Diesel plant in 1923 shows results in favor of the latter. From the table it will

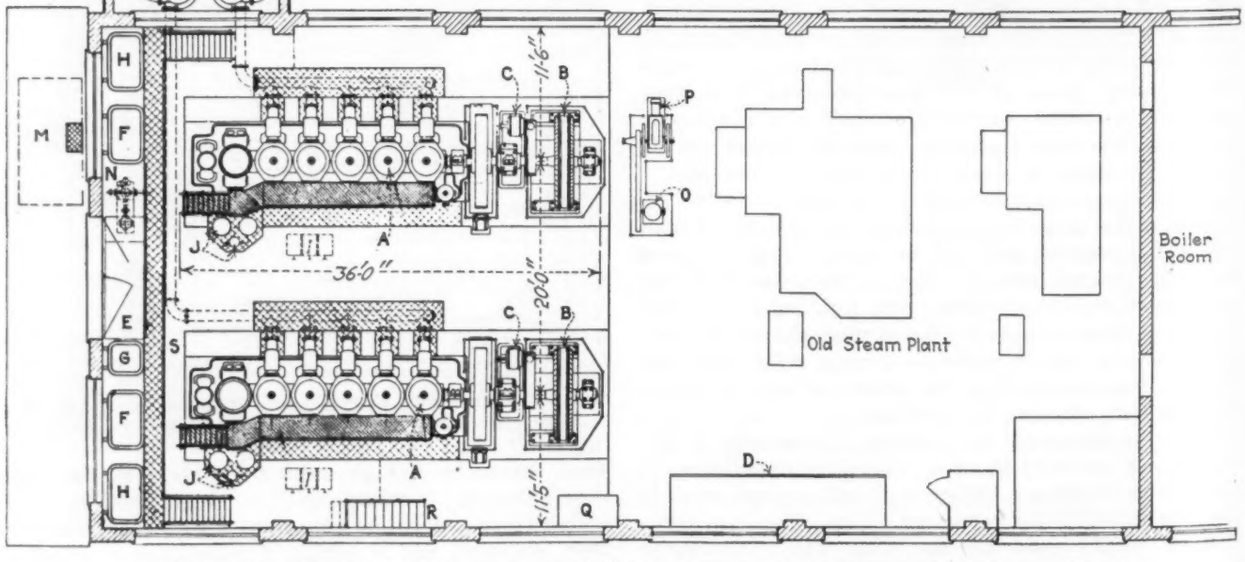


FIG. 4—THE PHYSICAL LAYOUT OF THE TWO 550-HP. DIESELS IN AN ENGINE ROOM 36 FT. X 42 FT.

A—550-b.-hp. Nordberg Diesel engines. B—375-kw. alternating-current generators. C—Chain-driven exciters. D—Switchboard. E—Fuel-oil service tank. F—Heavy-fuel oil tanks. G—Light oil tanks. H—Lubricating-oil supply tanks. I—Lubricating oil filters. J—Air bottles. K—Exhaust mufflers. L—Exhaust silencers. M—Hot-water sump. N—Motor-driven water-circulating pump. O—Nordberg auxiliary air compressor. P—Kerosene engine driving air compressor. Q—Superintendent's desk. R—Stairway leading to basement. S—Tank-operating gallery, located convenient to engines.

COMPARISON OF OPERATING COST WITH STEAM AND DIESEL UNITS

	Costs			Supplies		Output	Cost
	Fuel	Labor	Lubrication	Maintenance	Total Cost	in Kw.-Hr.	per Kw.-Hr.
Steam, 1922:	$22,368.82	$9,335.56	$441.70	$655.31	$32,801.39	709,190	$0.0462
Diesel, 1923:	3,651.21	10,027.53	405.26	93.12	14,177.12	1,132.000	0.0126

Saving in ten months' operations with Diesel plant	$18,624.27
Percentage saving with Diesel plant	56.8
Increase of load in 1923 over 1922, kw.-hr.	322,810
Percentage increase in load	45.5
Saving in cost per kilowatt-hour with Diesel plant	$0.0343
Percentage saving with Diesel plant	73.1

be noted that the savings during this period amounted to $18,624, which is 56.8 per cent of the cost for a similar period of operation with steam equipment. In making this comparison it must, however, be borne in mind that the output during 1923 increased 322,801 kw.-hr., or 45.5 per cent. The cost comparison should, therefore, be made on a kilowatt-hour basis, which shows a saving of 73.1 per cent in favor of the Diesel engine. These figures do not take into consideration the 15 per cent increase in the amount of water pumped by the Diesel plant, which would make the showing still more favorable. A comparison of costs and output of the two plants is shown graphically in Fig. 1. These savings have been made with rates for domestic lighting of 6 cents per kilowatt-hour, with a minimum charge of 50 cents a month and a power rate ranging from 2 cents to 3 cents. As is invariably the case when an abundant supply of cheap and reliable power is available, more use is made of the service than formerly.

Good street-lighting and water-pumping service is also afforded by this low energy rate. Forty-seven street lamps were in service in 1922, and the following year the number was increased to 147. In addition, there are twenty-two alley lights and 106 "white way" lights, all rated at 250 cp. The "white way" is nine blocks long. The expense is borne entirely by the lighting department and not by the business men. With the installation of the Diesel engine, the old compound direct-acting plunger pumps, having a capacity of 1,250,000 gal. per twenty-four hours, were replaced with motor-driven centrifugals. Duplicate units were installed, two for low-pressure service having a capacity of about 750 gal. per minute against a 35-ft. head for lifting the water from the river to the reservoir, and two high-pressure pumps having the same capacity, but with a 210-ft. head for pumping into the system. These pumps require virtually no attention, and the cost of operation is low in comparison with the old steam pumps.

This plant is operated by a superintendent and three engineers working in shifts of eight hours each, one pump man and one relief man. Prior to the Diesel installation none of the engineers had ever operated this type, their work having been with steam engines only. At the time the Diesels were on test at the factory the superintendent and one engineer spent a short time there to learn a few operating essentials in the care of Diesel engines. Further training imparted by the factory man who erected the engine has enabled the operators to take care of the plant satisfactorily. At no time since the Diesels have been installed has the power been off the line for any reason. The steam units in the old part of the plant have never been used since the Diesel plant was placed in regular operation, and they are now being dismantled.

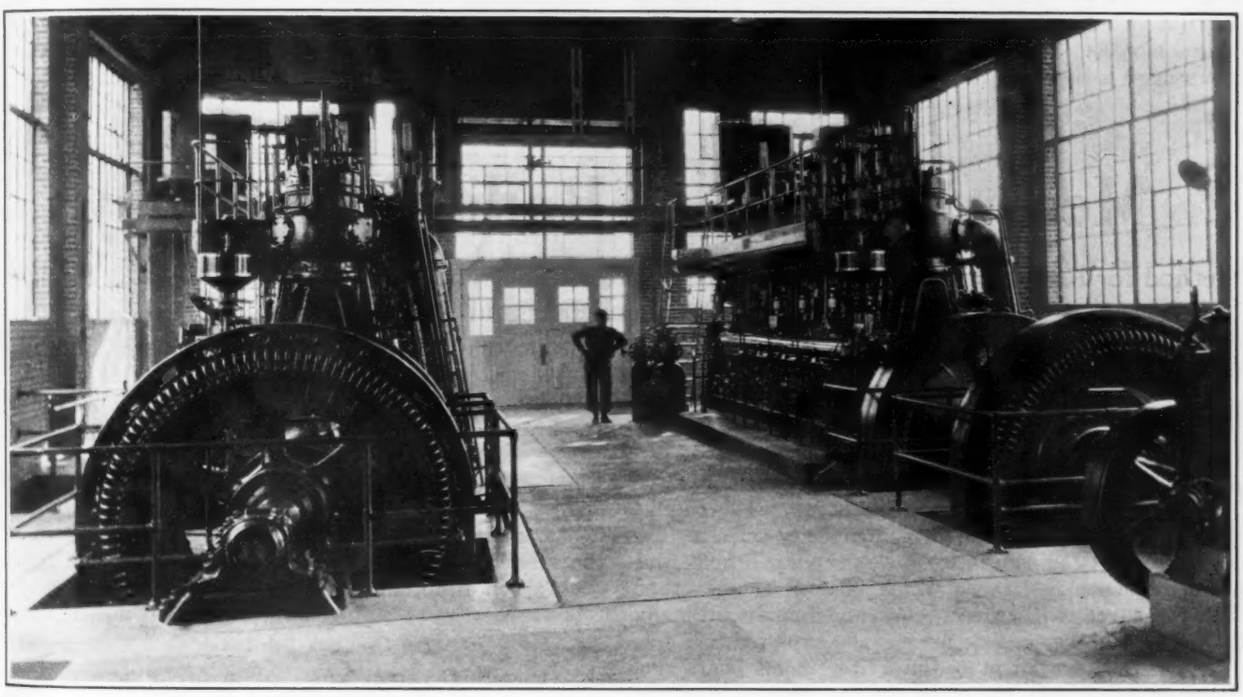


FIG. 5—THESE TWO DIESELS HAVE PRODUCED A SAVING OF 73.1 PER CENT PER KILOWATT-HOUR OVER THE OLD STEAM-PLANT OPERATION

Although the plant is now in operation with an average load for twenty-four hours of only 155 kw. (Fig. 2), or less than 20 per cent of the installed capacity, the municipality realizes that one of the largest factors in obtaining low power cost is a high load factor. In order to show the possibilities of increased earnings with a greater load and to determine readily the approximate earnings at any time based on the load carried, A. M. Burton, chairman of the Board of Public Works, submitted the report which is shown in Fig. 3.

Curve *A* represents the kilowatt-hour cost of the fixed charges while curve *B* shows the operating expense. The third curve, *C*, shows the total kilowatt-hour cost, which is the sum of the figures in *A* and *B*. In calculating these curves, Mr. Burton figured the fixed charges on the basis of a useful life of fifteen years. The management desires to increase the load to about 500 kw., so that the cost may be reduced approximately from 2¼ cents to ¾ cent.

At the present time one of the engines is kept in continuous operation for twenty-four hours a day for one week, the other serving as a spare unit. At the end of the week the other engine is placed on the line for a similar length of time. While the engine is idle it receives a casual inspection and such minor adjustments and repairs as may be required. It will be noted in the table that for ten months' operation the supply and maintenance costs have amounted to only $93.02, or $8.21 per each 100,000 kw.-hr. developed. This item of expense does not include repairs for the two engines. During the fifteen months of operation it has not been necessary to purchase a single repair part. The fuel consumption guarantee made by the manufacturer in pounds per kilowatt-hour with oil at 18,000 B.t.u. was as follows: For quarter load, 1.1 lb.; for half load, 0.74 lb.; for three-quarters load, 0.68 lb.; for full load, 0.65 lb.

Nine months after the engines were in operation tests made by Black & Veatch showed that these guarantees were being fulfilled. In a report submitted to Mayor Bogue they declared: "The general operation of the engines since installation has been very good. Our recommendation is that the engines be accepted by the city and final settlement made. It is our belief that your oil-engine installation is first class in every respect."

Further evidence that the plant is a success is obtained from the following statement made by Mayor Bogue: "A company offered to pay for this plant at cost, charge a 10-cent rate for electricity and agreed to give the plant back in as good condition as new, if permitted to take the receipts for ten years. Such an offer forcibly emphasized the economical working of an oil-engine plant, where results are obtained that steam equipment cannot possibly equal or even approach under similar conditions."

Measurements at Radio Frequency

Method for Rapid Determination of Effective Resistance and Inductance of Coils and Straight Conductors—Uses Variable Condenser and Resistor to Replace the Variable Inductor

By AUGUST HUND
Bureau of Standards

THE effective resistance of coils used in radio work varies with the frequency. The change is due to skin effect and capacity actions. The net effect can in some cases causse an effective radio-frequency resistance which is even smaller than that measured with direct current, though in many cases much higher resistance may be expected.

The method described by the writer* some years ago, although rapid, has the disadvantage that a standard variable inductor is required. For the average laboratory this is an essential drawback, since the effective resistance of the variable inductor changes not only with the frequency but also with the relative position of the movable and the stationary coils. This is also true for the effective inductance, since the frequency has an effect upon it also. Many calibration curves are therefore required.

Method.—The method using the arrangement shown in Fig. 1 does away with the above objections, since a variable air condenser *C* and a variable resistance *R* are used instead of the variable inductor. The calibration of such standards is relatively simple, and, with proper design, is independent of the frequency.

Let P_1 and P_2 denote the primary coils of a balanced air transformer. They are exactly alike, wound in opposition and symmetrically arranged with respect to the secondary coil *S*. The current-indicating instrument I_2 in the secondary *S* will give zero reading when the currents in the two differential branches have the same amplitude and are in phase. This can only happen when the inductance L_x of the test sample is in resonance with the capacity *C* of the standard air condenser and the resistance R_x of the coil is balanced by the standard resistance *R* in the other branch. For such a condition, we have:†

$$R_x = R,$$
$$L_x \text{ (henry)} = 1/4\pi^2 f^2 C, \qquad (1)$$

the capacity *C* being expressed in farads and the frequency *f* of the exciting current in cycles per second.

Application.—It is of advantage to carry on the determination as follows:

1. The test coil (L_x, R_x) is inserted into one differential branch in series with a variable condenser *C*.
2. The standard resistance *R* in the other branch is reduced to zero.
3. The differential system is supplied with just enough current *I* to indicate the off-balance in the transformer secondary. This can be readily done by coupling a few turns loosely to the radio-frequency source.
4. The capacity *C* of the standard air condenser *C* is varied slowly until a pronounced minimum deflection of the current-indicating instrument I_2 of the secondary is noted. This indicates the condition of voltage resonance in the upper branch of Fig. 1.
5. The current *I* is somewhat increased in order to have more effect on the current-indicating instrument I_2.
6. The standard resistance *R* is gradually increased

*ELECTRICAL WORLD, Vol. 65, No. 21, p. 1300, November 20, 1915.

†It is essential to use resistors whose valu s at the particular frequency are known. Short pieces of constantan wire of small size seem to be satisfactory for the entire range of frequency as long as the current through them does not produce appreciable heating.

until a more pronounced minimum indication is noted.

7. The current I is increased once more so that about 100 milliamperes flows to the system, giving 50 milliamperes through the test sample for a condition of balance.

8. The air condenser is adjusted by tapping the handle slightly in order to secure a very accurate resonance setting.

9. Finally, the resistance R is readjusted until an absolute zero effect is noted on the instrument of the secondary.

The setting of R gives directly the high-frequency resistance R_x of the test sample, and its effective resistance L_x is calculated from formula (1). The entire determination, including the computation, should not take more than five minutes.‡

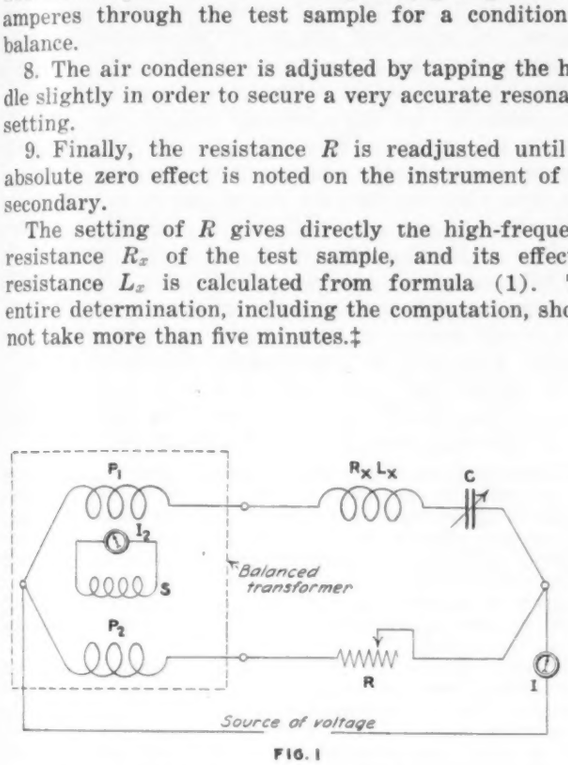


FIG. 1

Table I gives several determinations which were carried on with this method in order to show the sensitiveness. Two coils, A and B, of about the same shape and the same estimated inductance, were used. Coil A consisted of solid wire and coil B of high-frequency cable. For this particular range of frequencies the coil using high-frequency cable has less resistance. This can, however, not be generalized since the shape of the coil and method of winding play quite an important part in influencing the data obtained in the tests. The values in column b of Table II were found by the balanced transformer method two months before the values in column a and with the test coil and the standard in the two branches interchanged (in Fig. 1). The values of column a give the results of a determination with the test coil as is shown in Fig. 1. The values in the two columns show a satisfactory agreement.

The results obtained with the balanced-transformer method can be considered reliable, since the test sample and the standard are compared directly and simultaneously and the indicating instruments are inserted in portions of the system where they have no effect on the measurements. This is an inherent advantage of the differential method.

For ordinary work it is convenient to rectify the secondary current by means of a crystal and to use a portable galvanometer. A galvanometer requiring about 1 milliampere for the full scale deflection is very suitable. A thermo-galvanometer as an indicating instrument would require a smaller number of secondary turns within the range of higher frequencies in order to have the same sensitive arrangement. The detailed diagram of connections is shown in Fig. 2. The dotted portion indicates the portion which is shielded with copper sheets. It prevents external

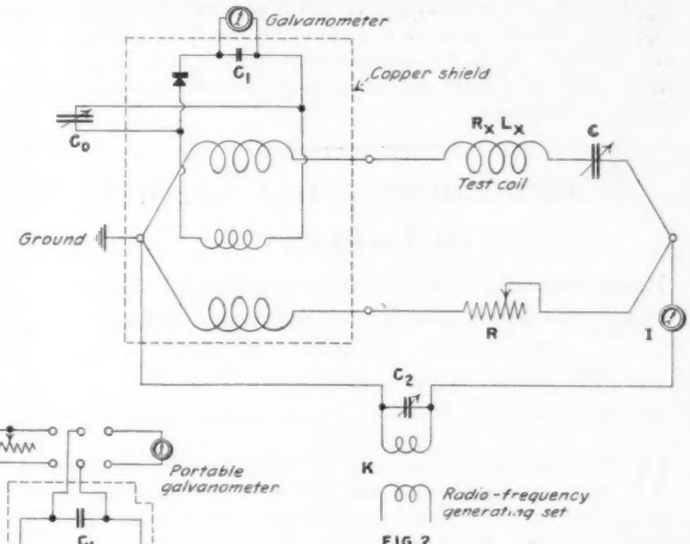


FIG. 2

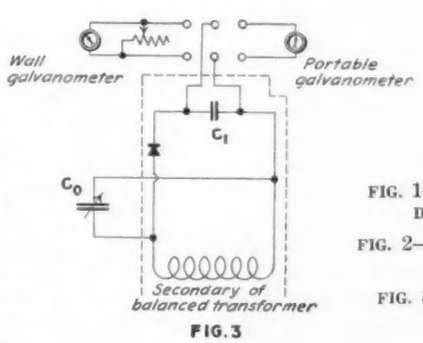


FIG. 3

FIG. 1—METHOD OF USE OF A VARIABLE CONDENSER AND VARIABLE RESISTANCE

FIG. 2—CONNECTIONS FOR SIMPLIFIED METHOD OF MEASUREMENT

FIG. 3—CONNECTIONS FOR VERY SENSITIVE MEASUREMENTS

effects from unbalancing the transformer and inducing disturbing emfs. in the leads connecting to the secondary of the transformer. Without such precautions an absolute zero adjustment is impossible and the determinations would be questionable. C_0 is a condenser for tuning the secondary of the transformer to resonance. C_1 is a fixed condenser of large capacity, 0.1 to 2 microfarads, depending on the frequency used. It increases the deflection of the galvanometer. C_1 and C_0 may be dispensed with in many cases. C_2 is the tuning condenser for the input side. With it and the coupling k to the generating set any current can be readily obtained. In all cases the coupling k should be chosen

‡The adjustment of the generator to the desired frequency usually occupies the larger portion of even this short time.

TABLE I—MEASURED AND CALCULATED VALUES

Coil	Frequency (f), Kilocycles per Second	Measured Capacity (C), Farads	Measured Resistance (R_x), Ohms	Inductance, Calculated from f and C, (L_x), Henries
A—Solid wire	150	1073×10^{-12}	4.0	1.051×10^{-3}
	200	595.11	6.2	1.064
B—High-frequency cable	150	1038	4.12	1.084
	200	579	4.3	1.095

TABLE II—COMPARISON OF THE BALANCED-TRANSFORMER METHOD WITH OTHER METHODS

Frequency (f) Kilocycles per Second	Resistance (R_x), Ohms, Measured with Balanced-Transformer Method a	b	Resistance Variation Method[1]	Inductance (L_x), Henries, Found by Balanced-Transformer Method a	b	Resonance Method[2]
150	4.00	4.00	4.1	1.051×10^{-3}	1.051×10^{-3}	1.058×10^{-3}
200	6.20	6.18	6.3	1.064	1.063	1.0705

[1] See circular 74 of the Bureau of Standards, page 180.
[2] An ordinary closed circuit containing an air condenser C and the test sample R_x, L_x, is tuned to resonance.

loose so that the differential system does not materially affect the frequency of the exciting source. It is possible to construct a balanced transformer which covers a very wide range of frequencies. For very high frequencies corresponding to very short waves it is best to use a transformer with a few turns only. For example, a transformer with ten turns for each primary and about 220 turns for the secondary wound on a wooden core about 15 cm. in diameter covers a range of from 0.5 kilocycle to 250 kilocycles. For very sensitive measurements it is advisable to use a wall galvanometer in addition to the portable galvanometer with a double-pole, double-throw switch, as indicated in Fig. 3. For the preliminary (rough) adjustment the portable galvanometer is used. Then the double-pole, double-throw switch is thrown to the left and a more delicate adjustment made. It is advisable to shunt the wall galvanometer and cut out some of the shunt as the final settings are reached. It is not convenient to cut out the entire shunt since the least disturbance would produce undesirable deflections.

Better Engineering Needed in Industry

Production and Economy Follow Adequate Installations—Many Bad Jobs in Existence—Typical Installations—Remedies Outlined

By C. B. WRIGHT

Equipment and Tests Department, Duquesne Light Company, Pittsburgh, Pa.

WHY pay for engineering service? Because capable engineering service will place your plant on a basis that will guarantee maximum production with high economy. This most desirable condition will not occur naturally, and it can be realized only after engineering principles have been applied to each phase of your operations. It is hardly necessary to mention that the application of these principles to a few of the operations will not result in either maximum production or high economy. These can be obtained only from a balanced application and a strict adherence to fundamentally correct operations.

In an industrial center such as the Pittsburgh district one might expect to find ideal conditions in so far as production and economy are concerned. In a center where industries are so diversified and the manufacturing possibilities are so good, owing principally to the proximity of the coal fields and the excellent transportation facilities, one might expect to learn that due consideration was being given to production and economy. Although this is partly true, a study of local conditions will indicate that there are many opportunities whereby both of these factors can be increased with consequent saving to the manufacturers.

Why do manufacturers persist in agreeing, and in fact insisting, that the utilization of electrical power is a non-technical element of their business? They are glad to purchase electrical energy at wholesale rates rather than attempt to generate their own power and they quote the higher efficiency, lower costs and convenience of the plan; but when the service connection has been made they are apparently satisfied that nothing further can be accomplished. The application and administration of the purchased energy is placed in the hands of operators who may be, but generally are not, capable of utilizing it to the best advantage. It is hard to get the viewpoint of executives who hire the best civil, chemical and mechanical engineering talent to solve their problems of production and absolutely neglect the electrical engineer's relationship to the problems when the entire production in many instances is dependent upon the utilization of electrical energy. For instance, an inconsistency should be charged against the executive who will maintain skilled chemists to designate the charges for electrical furnaces and then place the furnace operations in the hands of men who are not only unskilled in regard to correct methods of handling electric furnaces, but who are, in addition, completely ignorant of the most advantageous methods for utilizing the electrical energy required.

It would make too long a story to cite all of the specific instances of questionable utilization of electrical energy that have come to light during the past year. Some benefit, however, may be derived from the few general cases that will be described:

Customer A has two electric furnaces and a large number of induction motors. His demand with 100 per cent output is approximately 8,800 kw. and his monthly power bill ranges between $38,000 and $42,000. The customer employs an electrical engineer to supervise the furnace operations, but loses a large percentage of his services by refusing to provide meters and other equipment which might be used to advantage for plant testing and general maintenance work.

Customer B has an electric furnace which is serviced by a bank of three 200-kva., 11,000/110-volt oil-cooled transformers. The power company is adequately servicing the installation with a bank of three 500-kva., 22,000/11,000-volt oil-cooled transformers. The furnace demand from recording load tests is approximately 1,050 kva. The customer complained of low voltage at the furnace electrodes in the summer of 1923. Recording tests showed an overload on the 600-kva. bank and the customer was advised to install additional capacity. He recently entered a second complaint of low voltage and quoted the loss in furnace output that had resulted from the low voltage. Subsequent tests developed that the 1923 recommendations had been completely ignored. When it is remembered that furnaces offer the severest type of loading for transformers, and that this particular load is approximately 200 per cent of bank rating, it will be realized that this customer must continue to experience a loss of revenue until he awakens to the fact that he is forcing his transformers far beyond their limit of economical operation.

Customer C operates a mine. He purchases energy for lighting and power in the mine and for lighting in the employees' houses. The power company's meters are the only ones on the premises. Lights and appliances are in almost constant use in the employees' houses because there has never been any limitation imposed on this service. At a rough estimate at least 30 per cent of the total power bill results from unnecessary and indiscriminate use of this service. In this instance the judicious installation of low-capacity watt-hour meters and a few simple rules pertaining to the house service would undoubtedly reduce the total power bill by at least 20 per cent.

Customer D began his industrial career with a few induction motors. As his business expanded he acquired additional motors of ratings recommended by overzealous salesmen who were anxious to introduce their motors. Today, under normal operating conditions, the customer's total connected horsepower load from the motor ratings exceeds his electrical horsepower load as determined from kilowatt-demand readings by slightly more than 40 per cent. This is but one of the many cases of overmotoring.

Customer E has an installation of induction and synchronous motors. His wiring is obsolete and entirely inadequate to give even fair service. It was recently discovered that the wiring included some sections of ½-in. conduit which contained three No. 14 R.C.C. wires that were operating equipment at 2,300 volts. Disregarding the fire hazard, his production would be increased several per cent through the installation of modern wiring.

Customer F also operates several large induction motors

and two synchronous motors. With overexcitation of the synchronous machines the installation power factor could be held at unity and a material discount realized on the power bill. Because the attendants can watch the alternating-current ammeter reading increase for overexcitation, and because they believe that this increased reading means a much higher power consumption, the synchronous motors are continually underexcited and the installation power factor varies between 50 and 60 per cent. A little education in conjunction with a simple code of operating rules would prove beneficial in this case.

OTHER PHASES OF SUBJECT

The foregoing specific instances will serve to prove that there is a field in which engineering services can be applied to advantage. Other things, such as intelligent studies of machine diversities with the idea of reducing the kilowatt demand, more recent and quick-acting automatic furnace controls to reduce the unbalance factor, studies of individual machine requirements in regard to the type of motor best suited for the work to be accomplished, and real efforts made to secure the services of technically trained, rather than "shop-made," electricians will show increased production with higher economy if they are given the proper sort of treatment.

Although the Pittsburgh district has been cited and the data presented have been obtained in that district, it is not to be implied that the situation there is worse than in similar industrial centers. Indeed, it is probably better than in a great many other localities. However, no matter what the conditions may be in the various industrial centers, the fact remains that there is a wide application for engineering services and that these services are available for the solution of all problems dealing with production and economy. On the day when manufacturers and their executives realize the possibilities in the application of engineering services to the utilization of electrical energy the industrial world will have advanced one more degree along the efficiency scale.

Inauguration of an Electromechanical Institute at Lille

IN CONCERT with the Under Secretary for Technical Education and the University at Lille, France, there has just been founded in that city an electromechanical institute. It occupies the former building of the Institut des Arts et Métiers and thus has at its disposition an important equipment of machinery and tools. It also will be able to make use of the laboratories of the faculty of arts and sciences. Organized on entirely original lines, its program of instruction will be such that both the student and the industry will have advantages hitherto unknown in France. The instruction will supplement both ordinary engineering and electric science with a dual (or co-operative) course which will permit a student once enrolled to take charge of actual installations of electric power production or application.

The length of this supplementary course is reduced to the minimum of six months for students already in possession of that general knowledge which would presumably permit their passing the ordinary mechanical examinations. Thus at a minimum expenditure of time and money they are fitted for immediate employment in the higher positions which at the present time it is difficult to fill because of a dearth of competent men.

Various electric companies are giving encouragement and financial assistance to the project, which within the course of the next few years may be expected to furnish to them the technical personnel which the continually increasing number of central and distributing stations require.

France's Biggest Hydro-Electric Installation

WITH the regularization, as one undertaking, of the hydro-electric plants in its concessions in Savoy, the valleys of the Artly, Bonnant and Doran de Beaufort, the Société d'Électrochimie, d'Électrometallurgie et des Aciéries Électriques d'Ugine has completed a work of great potential economic interest for France. The base of the enterprise is the Lac de la Girotte, which in addition to its own waters is a natural reservoir for water pumped from nearby sources. The pumping is accomplished by excess electrical energy produced during the period of high water in the valleys, and it keeps the stored water of the lake in much greater volume than it would otherwise be. The pumping installation consists of two groups, each of 4,000 hp. and each composed of a hydraulic turbine, an alternator and a centrifugal pump. In times of low water the pump is uncoupled and the waters of the lake operate the alternator through the turbine as a generator.

Letters from Our Readers

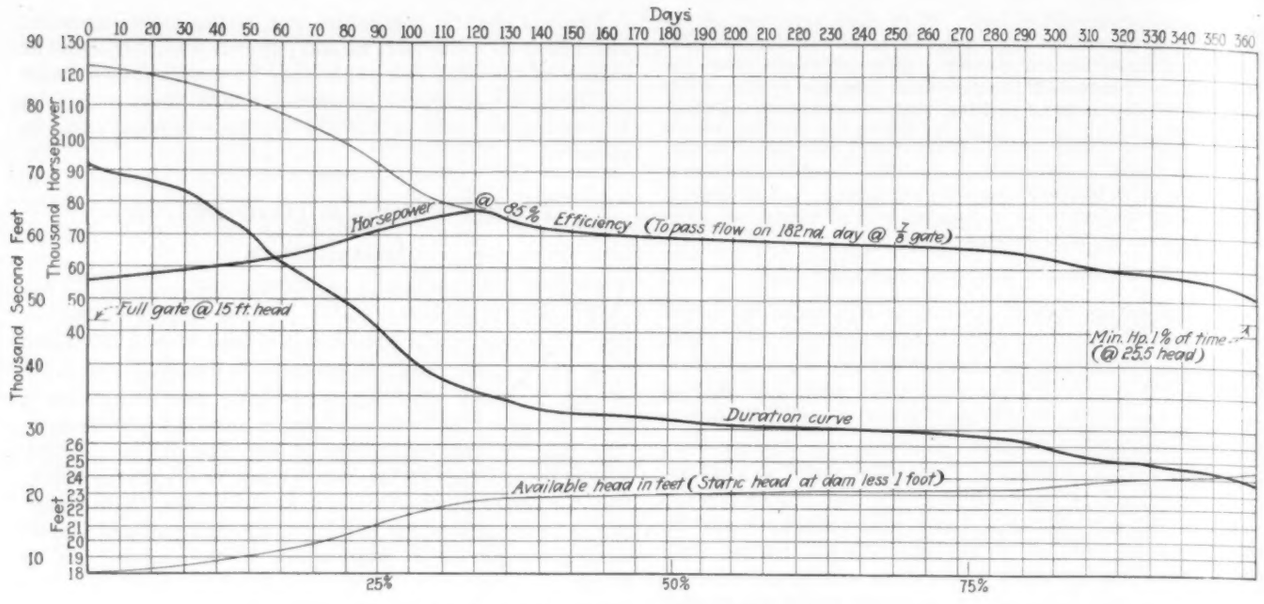
"Wanted—A Standard Method of Rating Rivers"

To the Editors of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD for October 11 (page 778) you issue a call for some one to devise a "standard method of rating rivers." More specifically speaking, this calls for a standard method of stating the value of rivers to furnish power. Unfortunately, a river is a very unruly member of the power-producing fraternity and resists strenuously any attempt to be put into a standard mold or form.

But something in the line of what is sought can be accomplished if a standard form of diagram, showing the power that the river will produce from day to day during an average year by means of a given power installation, can be established. Such a diagram has been used in the practice of the writer for many years. It ignores all forms of load factor and, it is contended, does this justly. A hydro-power station is one of the most permanent structures that men construct, whereas a load factor, in the nature of things, varies with time, the progress of inventions, what not. To couple two such incongruous elements in a design or a computation is very much like attempting permanently to entwine the quick and the dead. The expected load factor can enter into considerations of rates to be charged for the power to be sold and such speculation, but has no proper place in structural design, nor in a standard method of rating rivers. This last should show only the power, and the whole power, that a river will yield at a given power site, with due regard to economy of exploitation.

Now then, the use of a duration curve, showing *in their order of magnitude* what flow in the river may be expected during the days of an average year, or of


Days
Thousand Second Feet
Thousand Horsepower
Feet
Horsepower @ 85% Efficiency (To pass flow on 182nd. day @ 7/8 gate)
Full gate @ 15 ft. head
Min. Hp. 1% of time (@ 25.5 head)
Duration curve
Available head in feet (Static head at dam less 1 foot)
25%
50%
75%

FORM OF STANDARD CURVES TO RATE RIVERS

any other year, has become generally known and used. (Some call the 365 or 366 days of the year 100, and plot time in percentages, instead of in days; others plot the 365 or 366 days of the year.) Add to such a duration curve of river flow a curve showing the daily appurtenant fall in the river, and from the two deduce and plot a power duration curve, allowing for fall inevitably lost or wasted.

But such a power curve, taken as a whole, would assume an impracticable turbine installation. So now comes the only point subject to discussion, as it seems to the writer, in the adoption of a standard form of power diagram. What flow, of the average river duration-curve flow, shall be chosen as representing the ultimate amount of turbine capacity of discharge to be installed in the hydro-power plant?

The answer herewith respectfully submitted as the result of experience on rivers generally is: "That flow of the river that occurs on the year's midday, as given by the duration curve"; but in order to allow for a still greater necessary use of water during flood periods (when the fall is diminished), assume that with the stated draft of water the turbine speed gates shall be open, only at some point less than full gate discharge. Just what opening thus to choose must remain subject to the form and character of the river's duration curve of flow, but can be stated where the power rating of the river is stated according to the diagram. Such a diagram will have the form shown here. It tells the truth, the whole truth and nothing but the truth respecting the river's power rating, whereas all other methods that the writer has ever seen are mere subterfuges for, or concealments of, veracity.

Referring now to Harold W. Buck's instructive article (ELECTRICAL WORLD, September 20, page 607), such a diagram shows also the amount of steam power needed to enable the given hydro-power plant to co-operate economically toward any desired output of aggregate steam and water power. Before long it will generally be recognized, as should have been done long ago (and excepting only water powers on the outlets of the Great Lakes), that only by combining heat-engine power with water power can an investment in the latter be made to yield its maximum of return. If one assumes a uniform daily average output of power throughout the year, the diagram at once shows how it can be brought about, what the maximum heat-engine power requisite must be, how many horsepower-days or kilowatt-hours must annually be produced by heat-engine power, and the same for any other duty that may be assigned to the whole united power plant.

This form of diagram, to be made a standard form, is, for the reasons given, submitted as an answer to your call for a "standard method of rating rivers."

New York, N. Y. CLEMENS HERSCHEL.

Load Transference Between Alternators in Parallel

To the Editors of the ELECTRICAL WORLD:

A question which has arisen lately among several employees of one of our local power companies has aroused keen interest, but has not been settled entirely to the satisfaction of all concerned; hence we are taking advantage of your "Letters from our Readers" column, in the hope that it may attract interest and perhaps call forth a short article on the subject.

The subject of the discussion is load transference between alternators operating in parallel. It was claimed, backed by advice from the dean of the faculty of applied science of one of our universities and statements in "Electrical Power Plant Engineering" by Weingreen, that under certain conditions it was good practice to transfer loads between alternators operating in parallel by respectively increasing or decreasing their field excitation. This statement was contradicted by men of long operating experience with large hydro-electric units, their contention being that the only method of load transference was by either increasing or decreasing the prime-mover speed. After a long discussion on the theory of lagging and leading currents, it was thought that the question hinged almost entirely on governor design, and the subject was left still undecided.

Since our company is a subscriber to the ELECTRICAL WORLD, we should be very interested in discussion from other readers on this problem. ST. MAURICE.

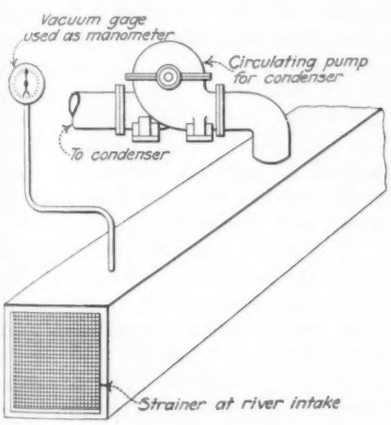
Shawinigan Falls, Quebec, Canada.

Central Station and Industrial Practice

Manometer Indicates Strainer Condition

By James Bivim
Assistant Chief Engineer Terre Haute (Ind.) Traction & Light Company

When taking circulating cooling water from rivers containing a large amount of mud and débris, such as the Wabash in Indiana, particular attention must be given the strainers to prevent their becoming clogged up so that the condenser will lose its circulating water. In order to prevent this, the Terre Haute Traction & Light Company has made use of old vacuum gages inserted as manometers in the intake line between the strainer screen and the circulating pumps, as shown



RECALIBRATED VACUUM GAGE USED AS MANOMETER

herewith. From this it is seen that with a clear screen the water level in the manometer rises to the same level as the outside water. But with a clogged screen the circulating pumps pulling through a restricted orifice will pull down the manometer water level. Thus the difference between these manometer levels will indicate the physical condition of the strainer. Instead of leaving this manometer in an inaccessible place, making it difficult to read, piping was run to the control board, where the other indicating instruments in the auxiliary pumping room are mounted. In place of regular manometers an old vacuum gage was used —recalibrated for this purpose.

The operators can tell by a glance at the gage just what the condition of the strainer is and also how soon it will be necessary to clean it. The reason for using this gage was because the auxiliary circulating pumps were steam-driven. If electric control had been used, undoubtedly some similar system could be employed, indicating when a greater load was placed on the pump motors. The use of this gage for telling strainer conditions is not new, however, since it has been installed for more than ten years. But it does foretell the danger of losing condenser vacuum by clogged strainers.

Series Reactance for Static Condensers

By H. M. Jalonack
Transformer Specialist, General Electric Company, New York, N. Y.

The application of static condensers for the correction of power factor requires not only reliability of equipment but an assurance that the power-factor correction is really secured. A condenser placed across an alternating-current line will draw a leading current, the amount of the current being proportional to the frequency. Any leading current taken by the condenser at fundamental frequency results in the improvement of the lagging power factor of the line. Currents taken by the condenser at higher frequencies than fundamental—that is, at any of the harmonics—will not improve power factor but will have a tendency to destroy the corrective effect of the leading current at fundamental frequency and will introduce harmonic currents into the system, which will have as bad an effect on the power factor as the lagging current, to correct which the condenser is installed.

It is therefore highly desirable that the harmonic currents drawn by a condenser be limited as much as possible and be kept from assuming appreciable proportions through resonance. Considering a circuit consisting of a capacity, an inductance and a negligible resistance, it is possible to derive a very simple formula wherein the harmonic at which resonance will take place is expressed in terms of the percentage of inductive reactance of the circuit.

Starting with the basic equation for the impedance of a circuit, the following formula may be derived:

$$H = \sqrt{100 / (P_{Lc} + P_{LL})},$$

where H = the existing harmonic, P_{Lc} = percentage of total impedance due to reactor furnished with condenser equipment, and P_{LL} = percentage of total impedance due to inductive line reactance.

Two cases will be considered, first, one in which P_{Lc} is 20, which is the case where a 20 per cent reactor is used with a condenser, and, second, where P_{Lc} is 0, which is the case where no reactance is used with the condenser.

CASE 1.

$$H = \sqrt{100 / (20 + P_{LL})}$$

Assume: $P_{LL} = 0$; $H = 2.2$ or second harmonic.
$P_{LL} = 1$; then $H = 2.1$ or second harmonic.
$P_{LL} = 2$; then $H = 2.1$ or second harmonic.
$P_{LL} = 3$; then $H = 2.08$ or second harmonic.
$P_{LL} = 4$; then $H = 2.04$ or second harmonic.
$P_{LL} = 5$; then $H = 2.0$ or second harmonic.
$P_{LL} = 6$; then $H = 1.9$ or second harmonic.

For values of P_{LL} in excess of 6 and up to 80 the harmonic is between the second and the fundamental. Since the second harmonic does not appear in alternating-current circuits, and since the fundamental frequency gives the power-factor correction desired, it is obvious that the use of the 20 per cent reactance eliminates the possibility of resonance.

CASE 2. $H = \sqrt{100 / P_{LL}}$.

Assume: $P_{LL} = 0$; H = indeterminate.
$P_{LL} = 1$; then $H = 10$ or tenth harmonic.
$P_{LL} = 2$; then $H = 7.07$ or seventh harmonic.
$P_{LL} = 3$; then $H = 5.8$ or fifth or sixth harmonic.
$P_{LL} = 4$; then $H = 5$ or fifth harmonic.
$P_{LL} = 5$; then $H = 4.5$ or fourth or fifth harmonic.
$P_{LL} = 6$, then $H = 4.1$ or fourth harmonic.
$P_{LL} = 10$; then $H = 3.1$ or third harmonic.

From the above it will be noted that with line reactances between 1 per cent and 10 per cent it is possible to get resonance at the third, fifth, seventh and ninth harmonics and where P_{LL} equals zero or some value less than 1 it is possible to get resonance at any one of the odd higher harmonics. Since the values of reactance given above lie within the range of those found in power circuits where condensers are applied, and since on such circuits pure sine waves are rarely if ever encountered, which means that some harmonics are present, it is obvious that the elimination of resonant conditions is assured only under case No. 1, that is, with a very appreciable inductive reactance as a part of the condenser equipment.

The voltage wave on the 2,300-volt bus of a large operating company with the condenser current waves for various values of series reactance is shown in Fig. 1. The extreme distortion with no series reactor and with a 3.5 per cent series reactor shows a marked contrast to the wave form with a 20 per cent series reactor. The latter was very little different from the original line-voltage wave form. As a matter of fact, with no series reactor the combined harmonic currents were 73 per cent of the fundamental, with 3.5 per cent series reactance 214 per cent of the fundamental, and with 20 per cent reactance the harmonic currents were found to be practically negligible.

A graphic illustration of the foregoing equation, showing the magnitude of the harmonic currents in percentage of the fundamental with various values of series reactance for 1 per cent harmonic voltage, is given in Fig. 2. Curves are given for the third, fifth, seventh and ninth harmonics.

As an example of the effect of these harmonic currents consider Fig. 3. Assume that sufficient condenser capacity had been added to correct the power factor from 70 per

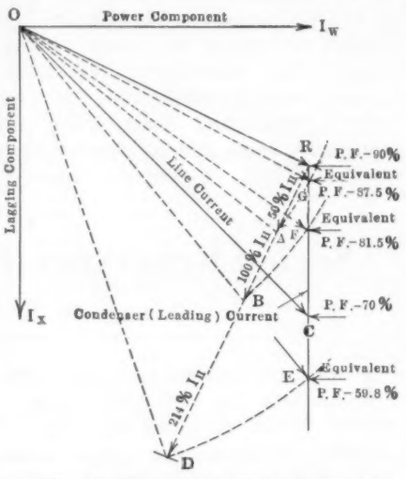


FIG. 3—EFFECT OF HARMONIC CURRENTS ON POWER-FACTOR CORRECTION OBTAINED WITH STATIC CONDENSERS

cent to 90 per cent. With a 50 per cent harmonic current the equivalent power factor becomes 87.5, and with 214 per cent harmonic current the power factor becomes 59.8 per cent. In other words, in this particular installation a condenser with a 3.5 per cent series reactance would have lowered the power factor from 70 per cent to 59.8 per cent, instead of raising it to 90 per cent.

Had the line reactance been 3.5 per cent greater, this same reduction in power factor would have taken place with no series reactor. This effect is shown graphically in Fig. 3.

In order, therefore, to be certain that the maximum corrective capacity of the condenser will be available under all conditions of line reactance and harmonic conditions, it seems essential to include a sufficient reactance with the condenser equipment to eliminate the possibility of resonance. It is obvious in the case of a system voltage which has practically a pure sine wave form that the condenser equipment would not require a definite value of series reactance in so far as harmonic interference is involved.

Construction Department Safety Rules

BY REQUIRING all their linemen to study a picked set of safety rules, the Kansas City Power & Light Company has lowered the number of accidents 60 per cent during the past three years, according to T. B. Bash, superintendent of overhead construction. In order to impress upon their minds the value of safety, these rules are read to small sections by the foreman at noontime once every month. Then questions are asked to make sure that the linemen really understand the rules. In order to keep a check on this policy, each lineman is required to sign his name to a statement saying that he has read the rules and understands them.

This policy has been very effective since the company first started four years ago to train its own linemen. The construction department consists of three classes: (1) Beginners, (2) ground men and (3) experienced linemen. In hiring men for beginners, care is taken to obtain a man of high caliber so that, plus experience, he can be promoted to a first-class lineman. All promotions are taken care of by examinations,

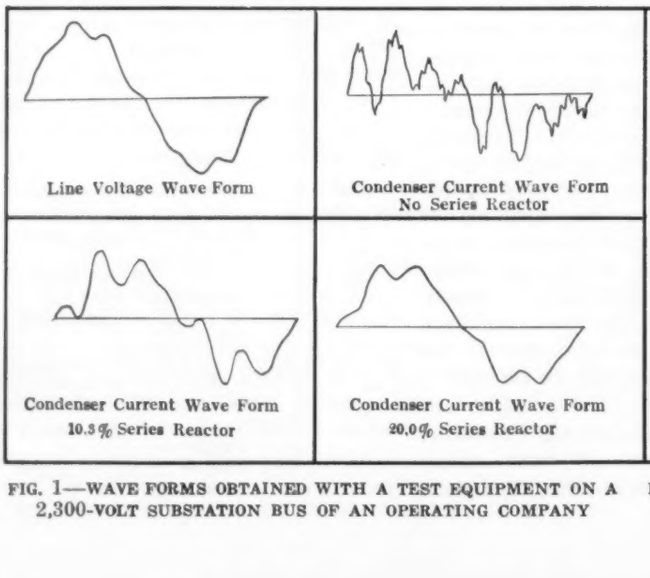


FIG. 1—WAVE FORMS OBTAINED WITH A TEST EQUIPMENT ON A 2,300-VOLT SUBSTATION BUS OF AN OPERATING COMPANY

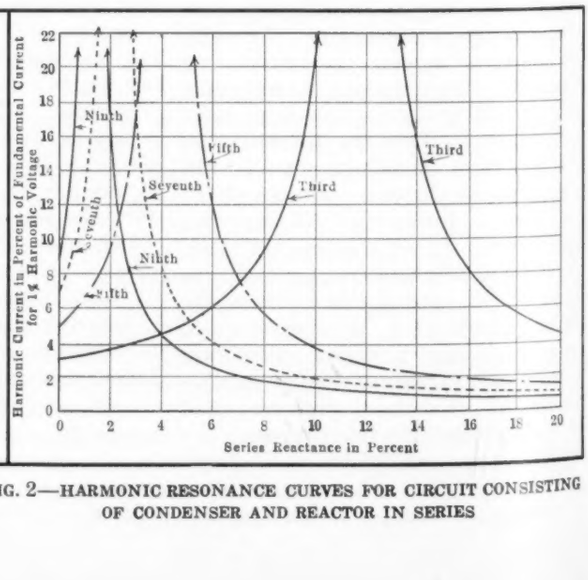


FIG. 2—HARMONIC RESONANCE CURVES FOR CIRCUIT CONSISTING OF CONDENSER AND REACTOR IN SERIES

where a passing grade is 80 per cent. It has been found that about a year and a half is required to make a first-class lineman. These linemen are then graded by the number of accidents, their ability and personality. After two accidents, where it has been proved that the lineman was careless and lax in his work, he is dismissed because of endangering the lives of the other linemen.

Some of the most important rules read to the linemen each month are as follows:

1. Linemen are not permitted to work on high-voltage live circuits until they have had sufficient experience with the system, and in no event before they have worked at least one month for the company.
2. Linemen must not work on a circuit unless they are thoroughly informed of its voltage and location.
3. Each construction wagon will be supplied with two or more pairs of rubber gloves, two rubber blankets, linemen's shields and a suitable box or receptacle for storing them. First-aid outfits and fire extinguishers also must be provided to be tested and inspected every thirty days.
4. Do not climb poles without first testing them carefully, satisfying yourself that they are safe to climb. Never climb poles, pole tops both on trolley and wood poles, ladders, scaffolds, trees, cross-arms or any other elevated structure without first assuring yourself that they will hold your weight.
5. Any employee working on an arc circuit must first notify the system operator, who will hold the circuit open until cleared by the party working on it. To avoid misunderstanding, and to prevent accident, each person receiving an unwritten message concerning the handling of lines and equipment must immediately repeat it back to the sender and secure his full name and acknowledgment. Each person sending an unwritten message should require it to be repeated back to him by the receiver and secure the latter's full name.
6. Linemen starting work on a 33,000-volt line must first get permission from the system operator. They must then ground and short circuit the line until all work is finished. After removing ground and short circuit, they must clear the line back to the system operator.
7. Linemen are cautioned against stringing wires, ropes or handlines across public streets without stationing some one to direct traffic.
8. Report to your immediate superior any dangerous condition of the company's equipment that may cause an accident.
9. When using solder and acid on poles or ladders, keep yourself in the clear, also having some one guard traffic so as not to cause an accident from falling hot solder.
10. Never throw tools or material from the top of the pole to the ground, or from the ground to workmen on the poles. Use the hand line and be sure you have the material or tool well fastened, so it will not become loosened.
11. Be sure to inspect the handle of the hammer, sledge or chopping axe so that the metal part will not fly off when it is being used.
12. Inspect your ropes and blocks before placing any weight on them to see that they will carry the load. Never overload an old rope; always determine whether the weight to be lifted is less than the strength of the rope.
13. When placing poles, removing poles, raising or lowering transformers, never allow traffic to approach so as to cause an accident in case the ropes give way.
14. In pulling in new lines to replace old ones, or pulling in lines on cross-arms where there are hot wires, be careful to see that your coils or reels are off the ground and well insulated.
15. Watch the gasoline furnace. Never put a pressure on the furnace of more than eight or ten strokes of the pump. Never attempt to adjust the coil when the furnace is burning. If the furnace has to be worked upon, put out the flame, release the air pressure and then do the repairing.
16. Never reach over one hot wire to work on another. Work from below if clearance is available. If not, blanket the wire or wires over which the work must be done.

Training Substation Operators

Proper Selection of Men Important Step Toward Preventing Accidents—Details of Instruction Course of Commonwealth Edison Company

BELIEVING that the workman himself is the foundation of an effectively functioning safety organization, the Commonwealth Edison Company of Chicago has sought to select and train a force of operating men who, with the aid of modern equipment and safety devices, shall be capable of operating a substation with a minimum number of injuries to themselves, interruptions to service and damage to equipment, declared Homer E. Niesz, manager of industrial relations, before the National Safety Council, Louisville, October 1. Proper selection of new employees is the most important step toward preventing accidents. The highest possible appreciation of responsibility must be insured. For this reason the company chooses only men who have reached the age of twenty-one years. Previous electrical experience is not required. Although a grammar-school education is the only definite requirement, preference is given to young men who have completed high-school, trade-school or correspondence-school training.

The final choice of men is made by a member of the department who is thoroughly acquainted with all the conditions and requirements of the position. After acceptance by the employment office, the applicant is examined by the company physician. Great care is exercised in this examination to insure elimination of all applicants who are subject to organic defects. Special emphasis is placed on heart lesions, defective vision or hearing and evidences of epileptic tendencies.

The training of apprentices is in direct charge of the chief operator of the substation to which he is assigned. The new employee is at once informed of the location of dangerous equipment about the substation and the precautions to be observed in its vicinity. During the first few days the new man is taught the Schaefer prone-pressure method of artificial respiration. These apprentice operators are also required to attend classes in the Central Station Institute two hours weekly on the company's time, where instructions are given in elementary electricity. After the apprentice becomes qualified as a certified operator, his further attendance in these classes is optional and will be in his own time. In the substation the chief operator lays out for the apprentice a systematic course of study, to which, with operating instructions, two hours a day are devoted.

INSTRUCTION COURSE

This course of study includes:

1. Rules for safety of employees and emergency operating instructions. These are issued by the company and include general safety rules, rules governing placing equipment in and out of operation, emergency operating instructions and instructions in case of accidents.

2. Rules and regulations of the substation department, which contain operating experience over a long period of time.

3. The substation description, which is a detailed write-up of the individual substations, giving details of operation and any peculiarities that may exist in that substation.

This serves as a guide for relief and emergency operating.

4. Substation diagram, consisting of a one-line diagram of substation buses and more important apparatus.

When the apprentice has been in the substation a sufficient length of time to become familiar with his surroundings and has made sufficient progress in his studies to begin to understand the various operations performed, he is permitted to perform operations with the equipment, but only under the guidance of a certified operator. At all times this operator is responsible for the safety of the apprentice and the operations he performs. The apprentice is permitted to perform these operations under the direction of the operator only after he has indicated specifically each move he intends to make and has received the operator's approval. No apprentice at any time in his training is permitted to perform operations upon his own responsibility. In the use of safety appliances, such as protective gloves, leather coats, insulated steels and so forth, he is taught that the failure to use the safety equipment provided is a serious offense and is considered proof of a careless disposition.

Reports of Apprentice's Work

The chief operator submits weekly reports on apprentice training which cover the progress in study and the operations performed during the week. The chief operator also reports his observations of each man's characteristics with respect to careless tendencies, absent-mindedness, mechanical method of performing work and any erratic inclinations. Men who display such undesirable characteristics are carefully taken in hand with the object of correcting these faults if possible. It is desirable to remove from operating work those who are unable to adjust themselves to it, and it is, of course, much better that this be done before an accident happens. The apprentice during this course receives training in a sufficient number of substations to insure experience in the various classes of equipment found in substations operating the Edison 115-230-volt direct-current three-wire system, the 4,500-volt and 12,000-volt, 60-cycle systems and the 600-volt railway service system.

To become a qualified certified operator an apprentice must pass an examination before a board consisting of a chief operator and one or more members of the staff of the superintendent of substations. At this examination a definite rating as to competency is given to him and is recorded for future reference. In a similar way all certified operators before taking new shifts in their own or other substations are first certified by examination. The questions for these examinations include general questions on the company organization and electrical system and specific details pertaining to the operation and maintenance of the substation to which the man under examination is assigned. Questions pertaining to safety cover the safety organization of the company, rules for accident prevention, first aid to the injured and the proper use of medical supplies. Chief operators examine monthly each man under their supervision on the questions used in certifying to the next higher position, with special reference to emergency operating and safety procedure.

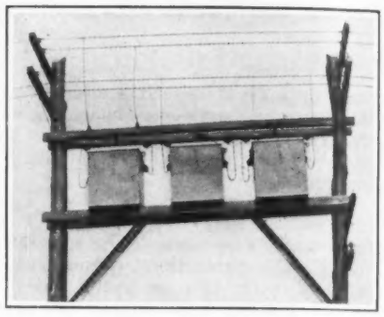
Safety Organization

The safety organization of the substation operators and apprentices is an important factor in the accident prevention work. Their meetings are conducted under the direction of their own elected chairman. A representative from the main safety division of the company is in attendance to present matters from that division. Programs are prepared by the employees' chairman with such aid as he may seek from the departmental safety committee head. A decided preference for the presentation and discussion of matters pertaining to their own particular work has been evinced, rather than for general talks on safety subjects not pertaining to their work directly.

Bulletins are issued following the occurrence of serious accidents or operating errors. In these bulletins the cause and result of the accident or error are given and the proper procedure to avoid a recurrence is stated. The company believes that a comprehensive program of accident prevention in substations, to be consistently maintained, should include the proper selection and training of men, definite rules covering safety and operation, periodical examinations as to competency, discipline, close supervisory contact, modern equipment, safety devices, personal responsibility and an efficient safety organization within the department.

Power-Factor Correction by Static Condensers

FOLLOWING the installation of six 30-kva. static condensers, the power factor of one of the Public Service Electric & Gas Company's circuits was increased from 69 per cent to 86.4 per cent. The line current was reduced from 200 amp. to 160 amp. per phase. The circuit in



POWER FACTOR OF 4,000-VOLT FEEDER RAISED FROM 69 TO 86 PER CENT BY STATIC CONDENSER

question is fed from the Irvington substation and is a four-wire, two-phase, 2,400-volt circuit with No. 4/0 overhead lines. The length is about 8,000 ft. and the condensers are installed about 4,500 ft. from the substation at the load center. The condensers are of the pole type, but, instead of hanging them as originally planned, they were set in groups of three on wooden platforms between poles, as shown in the above illustration.

Although the reduction in line current represented the load carried at the time of the test, the circuit had been carrying 300 amp. per phase.

Single-Conductor Cables for Distribution Service

By C. B. Hefner
Superintendent of Distribution Dallas (Tex.) Power & Light Company

TO FACILITATE tapping primary mains and secondary circuits in the underground district, the Dallas Power & Light Company employs single-conductor cable exclusively in these parts of the distribution system. The single-conductor cables also have the advantage that less cable is damaged when there is a burnout than where three-conductor cable is employed. A three-conductor cable is used in the distribution system only up to the point where the feeder taps the primary mains.

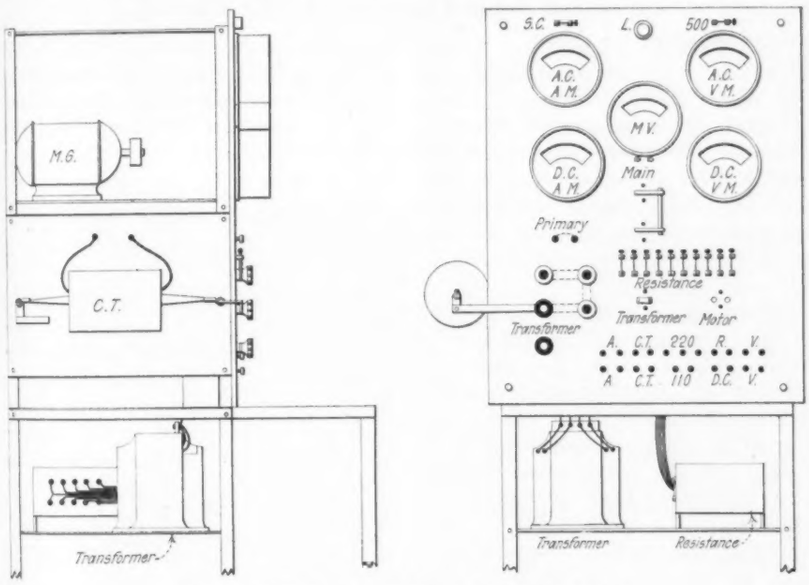
Flexible and Portable Test Table

BY H. E. REYNOLDS
Shop Superintendent Superior Switchboard Company, Canton, Ohio

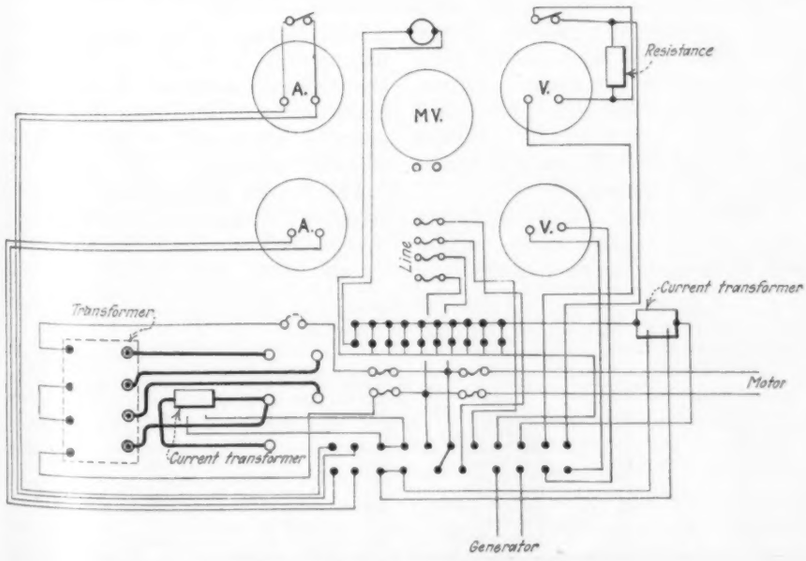
THE compact test table shown in the accompanying illustration has been designed by the writer to meet the needs of the testing department of this company, which requires a very flexible and ready means of testing. It consists of a 1½-in. x 1½-in. x ⅛-in. angle-and-rod construction frame, allowing a 24-in. x 30-in. work table in front of a vertical ⅜-in. ebony asbestos panel, 24 in. x 30 in., which is practically "dead front." The top is protected with a No. 16 gage steel plate against falling objects. Two No. 10 gage shelves are provided in an inclosure behind the panel, on which are mounted all apparatus, including a motor-generator set. On the left side is mounted a current transformer panel of ⅜-in. ebony where any size of current transformer can be readily installed by means of clamps.

Terminals of all meters and apparatus terminate in insulated binding posts, allowing any meter or apparatus to be connected in any circuit or in any manner. The loading transformer, by means of series-parallel connection on high and low sides, gives a load current range from 30 amp. to 300 amp. in steps of about 30 amp. A load box is also used which gives a load current range up to 32 amp. in steps of ¼ amp. The load box can be used in conjunction with the loading transformer primary by means of a binding-post gap, which connects the load box in series for current regulation.

The test panel occupies about 8 sq.ft. of floor space and weighs approximately 250 lb. Pratically any shop or factory test can be quickly performed, such as temperature test or load test, resistance measure, potential or overvoltage test, continuity or short-circuit test, trip-coil calibration, watt-hour meter with rotating standard, power - factor tests, armature testing, etc.



ARRANGEMENT OF APPARATUS FOR TEST TABLE



CONNECTIONS FOR EXTENSIVE TEST PANEL

Desirable Location for Stoker-Drive Motors

BY R. D. GILLESPIE
Plant Superintendent Dayton Power & Light Company

IN APPLYING motor drive to stokers a variety of practices have been followed, such as placing the motors below the firing-aisle floor, mounting them on the floor below the stoker, on one side of the boiler near the end of the stoker, or on the firing-aisle floor below the end of the stoker. While each of these practices has its advocates, some of these positions have disadvantages in requiring long connecting drives, being exposed to dirt and dust or presenting an obstruction to work in the boiler room, on the furnaces or stokers.

In the Millers Ford station of the Dayton Power & Light Company an endeavor has been made to avoid these objections by mounting the stoker motor on a two-speed gear box immediately below the coal hopper. In this position very short connecting drives can be used, the motor is off the floor and there is no obstruction to work on the stokers. An inclosed silent chain drive is used.

Each stoker has two motors, either of which has ample capacity to drive the stoker. One motor is held in reserve. The motors are rated at 10 hp. at 1,080 r.p.m. with 250 volts impressed on the armature. Thirty per cent speed increase is permitted by means of a field rheostat control on each motor field. Additional speed regulation is afforded by the Ward Leonard system, a motor-generator set being provided for each row of three boilers. A spare set can be used on any row of boilers. The two-speed gear box on which the stoker motor is set is of the planetary type, and therefore no clutch is required. The control handle is within very convenient reach of the boiler-room attendant.

Central Station Business

Brass Furnaces Offer $15,000,000 Load

AT PRESENT there is installed in this country more than 60,000 kw. of electrical capacity in electric brass-melting furnaces, according to E. L. Crosby, president of the Detroit Electric Furnace Company, who reports that 31,000 kw. in Detroit furnaces is in use. Of this, 15,000 kw. is installed in the Detroit Edison Company's territory and 10,000 kw. is on Detroit Edison service. To indicate the opportunity for still more electrification of brass melting, Mr. Crosby points out that 15 to 18 per cent of the brass melting in foundries and rolling mills in this country is done electrically and that 75 per cent of the total produced in sheet mills is melted electrically. Considering foundries alone, only 12 per cent of the brass is melted electrically. The experience in these installations indicates that there are sufficient savings from electric operation to justify a change from fuel-fired furnaces to electric furnaces. Aside from the high thermal efficiency (210 kw.-hr. to 325 kw.-hr. per ton) and the saving in metal loss, which is reduced to about one-half of 1 per cent in electric furnaces, there is the uniformity of analysis made possible by electric-furnace operation and control, which assures the highest-grade product and eliminates excessive rejection of finished castings, thus saving the unnecessary cost of pouring, making cores and molds, machining and remelting defective castings which must be charged to a non-uniform product. This is a saving, declares Mr. Crosby, which in many cases has been overlooked.

According to data obtained from one central-station company having a number of brass-melting furnaces on its line, typical performance of electric furnaces is as shown in the accompanying tabulation.

Basing his opinion on a very thorough survey of the country, Mr. Crosby concludes that electrification of brass-melting furnaces can be economically justified in installations requiring a total of between 225,000 kw. and 250,000 kw. Figured on the average working hours of existing installations, such an electrification of brass-melting furnaces throughout the country would increase the consumption of energy 600,000,000 kw.-hr. per year. At an average rate of 2½ cents per kilowatt-hour, this would mean $15,000,000 additional income per year for central-station companies aside from the benefit which electrification would bring to the brass industry.

Keeping Appliances at Work

How One Central-Station Company Developed a Large Repair Department and Some Experience It Has Gained

ELECTRICAL appliances while out of order consume no energy, and repair troubles discourage the purchase by consumers of other appliances. For these reasons the Detroit Edison Company has steadily built up a huge repair business and has gone to unusual lengths to give its consumers exceptional service in this respect.

Repair jobs and service calls made by this company during 1923 numbered 173,928; for the first six months of 1924 they numbered 90,719, and for the month of August last they reached the high mark of 19,169, an increase of 1,695 over the corresponding month of last year.

Of the repair jobs and service calls made in August, 15,772 were jobs taken care of in the shop and stations, 2,472 were calls made in homes for the purpose of repairing domestic appliances, 87 were motor calls, 223 were repairs on electric ranges, 42 were washing-machine calls, and 573 were miscellaneous trouble calls—a total of 3,397 calls in homes or places of business.

It is interesting, too, to study the nature of the repairs made. Appliance cords give more trouble than any other unit. No less than 13,392 of the 15,772 repair jobs handled in August were cord repairs. Other repairs made in the shop were as follows:

Domestic flat-irons	1,134	Warming pad	17
Curling irons	611	Sewing machines	31
Toasters	360	Tailor irons	30
Sweepers	78	Air heaters	23
Percolators	76	Vibrators	11
Hair driers	9		

Statistics compiled by the company indicate that appliances are used more during the hot summer months than at any other time, although the variation is not so great as might be supposed. The number of repairs and service calls made each month for a year, beginning with August, 1923, is as follows:

August (1923)	17,474	February	12,932
September	13,994	March	14,348
October	16,342	April	15,925
November	14,745	May	16,110
December	14,620	June	16,041
January (1924)	15,327	July	17,448

The August, 1924, figure, 19,169, has already been given. In considering these statistics it should be borne in mind that the number of users of appliances in Detroit is increasing rapidly.

The repair department is maintained as a matter of service, and charges seldom cover the cost of materials used. For several years it

OPERATING DATA FROM ELECTRIC BRASS MELTING FURNACES

Installation	Type	Furnace No.	Furnace Size, Lb.	Rating (Kva.)	No. Heats per 24 Hours	Kind of Product	Kw.-Hr. per Ton	Metal Loss, per Cent	Lining Life in Heats	Electrode Consumption in Lb. per Ton
1	Arc	1	2,000	300	20	Red brass	290	0.5	1,200	4
2	Arc	6	2,000	300	20	Yellow brass	210	1.0	750	4
3	Arc	1	1,000	150	20	Red brass	300	0.5	1,500	4½
4	Arc	1	750	125	20	Red brass	300	0.5	1,500	4½
5	Arc	1	500	75	20	Red brass	325	0.5	1,500	5
6	Arc	2	250	60	38	Red brass	265	0.5	1,750	6
7	Induction	24	600	60	22	Yellow brass	200	0.75	1,700	..
8	Resistance	2	1,500	105	9	Red brass	450	0.5	1,000	..
9	Foundry practice	1	1,500	105	10	Yellow brass	375	1.0	1,000	..

was the company's custom to take in an appliance cord for repair and give the customer a cord that had already been repaired, instead of making her wait till her own was fixed. Hers was then repaired and exchanged for another in need of repair, and so on. No charge was made for repairs and no questions were asked. Repair jobs began coming in so fast, however, that it became impossible to keep a stock of repaired cords on hand to give in exchange, so the company bought a supply of new ones and now makes a charge of 75 cents for a new cord given in exchange for an old one. About one hundred cords are sold daily at this price. The sets cost the company considerably more than this, even in lots of 10,000, but the old cord is taken in exchange. No charge is made for a repaired cord given in exchange for one to be repaired unless some part, such as the bushing, is missing or broken, and the charge then is small. All appliance cords are sterilized in a formaldehyde oven before being repaired.

APPLIANCE REPAIR SHOP OF DETROIT EDISON EMPLOYS FIFTEEN MEN

A large repair shop, in which fifteen men are employed, is maintained for repairing appliances only and several men are employed on the outside. While this repair service has grown to huge proportions and now entails a considerable expense, J. C. Burton, manager of appliance sales, points out that if some such provision were not made, many appliances would be standing idle and sales of others would be retarded. It is believed that less criticism of electrical appliances is made in Detroit than in some other cities, and this is doubtless due to the fact that the Detroit Edison Company does everything possible to keep appliances in working order and their users proud of them. It is surprising, Mr. Burton says, how many appliances will be found idle and how much dissatisfaction will arise when every effort is not made to keep them in repair.

By giving exceptional service in this respect the company not only keeps electrical appliances in its city working, but also encourages sales of other appliances by keeping the householders more than satisfied with their investment.

Threshing as a Possible Rural Load

INTERESTING figures have been compiled following an experiment made this fall by two Illinois farmers who used an electric motor to replace a traction engine and gasoline tractor for driving their separator in threshing wheat and oats. This electrical equipment was pictured on page 701 of the Sept. 27 issue of the ELECTRICAL WORLD. It is probably the first experiment in this country in which electric power was used for threshing and where each item of expense was carefully tabulated.

The trial was made on the Funk farms near Bloomington, Ill., in cooperation with the Illinois Power & Light Corporation, whose transmission lines run near the Funk acreage.

Electric motor drive, they found, reduces the cost of threshing oats 60 per cent. This conclusion was based on the fact that an engine and boiler threshing outfit, including water wagon, cost $4,150. The interest, depreciation, taxes and insurance aggregates $622. Operating expenses, including 45 tons of coal per season, labor of three men with teams, oil and supplies, and repairs and maintenance totaled $1,577. The cost to thresh 60,000 bushels of oats was two-thirds of the total, or 1.75 cents per bushel, and the cost to thresh 15,000 bushels of wheat, one-third of the total, was 3.5 cents per bushel.

To install the 40-hp. electric motor and mount it upon a wagon cost $700. The transformers and the wagon upon which they were mounted, the meter switches, cut-outs and wiring cost $1,092 additional.

The interest, depreciation, taxes, and insurance brought the total fixed charges up to $269. Repairs, oil, supplies and labor of one man came to $210 more. The cost of threshing 60,000 bushels of oats, the current rate being 7 cents per kilowatt-hour, with total operating expenses of $655, was 1.1 cents per bushel, and the cost to thresh 15,000 bushels of wheat was 2.1 cents per bushel. The comparison shows that the cost of threshing oats by electricity was slightly more than half as much as when steam power was used and that the cost of threshing wheat by electricity was approximately two-thirds as much.

According to the McLean County Farm Bureau figures, the average cost to thresh oats, using steam power, is 2.5 cents per bushel and to thresh wheat 4.5 cents per bushel. As tested upon the Funk farms, therefore, electricity reduces the cost of oats threshing 60 per cent, and the cost of threshing wheat by electric power is less than half as much as the average.

The threshing season upon the Funk farms lasted thirty days. The cost of the various outfits were carefully computed by the farmers and checked closely with the items upon other farms of central Illinois. They can be verified at any time. The life of both the steam and electric equipment was estimated to be fifteen years. There are many items to be taken into consideration, however, other than the mere cost per bushel. The danger of fire, ever present with the steam traction engine; the annoyance of hauling coal and water, frequently a long distance; the danger of an explosion, the loss and inconvenience when a halt is necessary for repairs or adjustment, all inherent disadvantages of steam or gasoline power, are important considerations favoring the use of electric power on the farm.

Canadians Oppose Tax-Free Government Utilities

GOVERNMENT-OWNED utilities in Canada may be faced with the unpleasant duty of paying taxes just the same as private companies do if the sentiment expressed in a letter from the council of the Montreal Board of Trade to Premier King interprets the public attitude correctly. The letter represents a crystallization of opinion that has been unofficially aired for several years in Montreal and in other parts of Canada. The Board of Trade has called the attention of the Prime Minister to the fact that although privately owned public utilities pay enormous taxes on their profits, publicly owned utilities pay no income taxes. As a result, the country as a whole is contributing to the relief of citizens in communities served by publicly owned utilities.

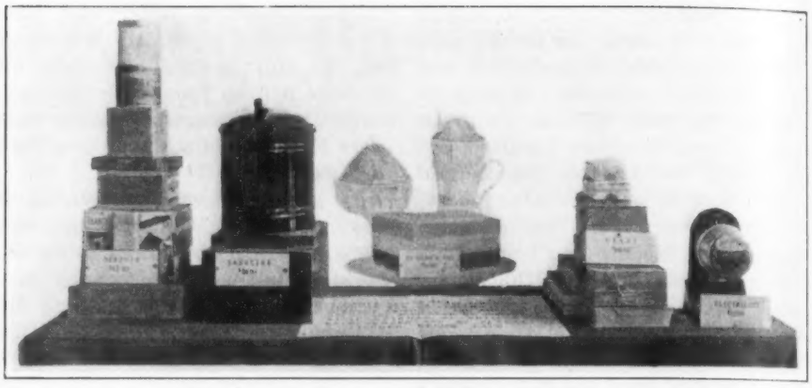
The council suggests that utilities be taxed on gross revenues and that privately and publicly owned organizations be equally taxed. It says:

For example, the Montreal Light, Heat & Power Company paid last year some $650,000 in federal income tax, which, of course, increased by a like amount the cost of gas and electricity to the community. The levy is not complained of, and it is recognized that the company must pass it on to its customers. The point is that the consumers of gas and electricity in this city thus made, in respect of their consumption, a large contribution to the federal exchequer, while the consumers of gas and electricity supplied by publicly owned utilities made no corresponding contributions.

In the opinion of the council, questions of comparative efficiency of management or comparisons of rates charged by publicly owned and privately owned utilities do not properly enter into the matter. Publicly owned utilities owe their origin to the belief of certain communities that better service can be obtained from them than from privately owned utilities. If that is the case, their customers already enjoy an advantage over the customers of privately owned utilities, without getting exemption from federal taxation as well. If, on the other hand, the management of any publicly owned utilities should prove less efficient than private management, the communities served should find the remedy themselves. They have no claim to relief at the expense of the country at large.

The council does not wish to be understood as asking relief for the citizens of Montreal; it merely wishes to point out the existing discrimination against this city and all other communities served by privately owned utilities, and to ask that the government consider whether, in fairness, the same contribution to the federal exchequer should not be made by all citizens in respect of the services they get from public utilities. Besides being equitable, this would mean a welcome addition to the public revenue.

The council begs to suggest for the consideration of the government that the laws be amended so that income tax on public utilities will in future be based, not on profits, but on gross revenue, and that the rates will be applicable alike to all utilities, whether publicly or privately owned.



AVERAGE FAMILY'S YEARLY EXPENDITURES FOR LUXURIES AND FOR ELECTRICITY
Tobacco, $95; gasoline, $68; ice cream, $50; candy, $48; electricity, $25.

Cost of Electricity and Luxuries Compared

IN DEALING with complaints of the cost of electricity it is a good plan to show the customer a comparison of the yearly expenditures for electricity and those for luxuries. It is often very effective to point out that even with a liberal use of electricity its cost is lower than that of any items on the luxury list—comprising expenditures for candy, ice-cream sodas, gasoline and tobacco—about which the average citizen thinks little.

A graphic display showing the relative expenditures for these items was made by the electrical engineering department of the Iowa State College at the Iowa State Fair in Des Moines. As shown in the illustration, this exhibition gives these yearly costs to the average family for luxuries and for electrical energy. A practical comparison of this kind may well be permanently displayed in every utility office to show by example how cheap the use of electricity really is.

A Code of Ethics for Utility Men

Unanimously adopted by the Kansas Public Service Association, October 25, 1924, at Emporia, with the suggestion that copies be posted conspicuously in utility offices and plants to remind utility men of their obligations and to acquaint the public with the principles which guide them.

PUBLIC utilities are natural monopolies and as such should be subject to public regulation as to all matters touching public interest. If public regulation is to be successful, it must be intelligently administered, but it cannot be so administered by an uninformed public. Therefore:

1. It is the duty of all members of this association to avail themselves of every opportunity, and to seek opportunities fully and honestly to acquaint the public with all matters relating to the operation of public utilities.

2. Public utility managers are trustees, whose duties are to safeguard and protect the interests of the public, the employee and the investor, and the acts of such managers should be influenced by a full realization of these responsibilities.

3. It is the duty of every member of this association to strive in every way to promote peace and harmony among its members and to uphold and support every honest policy or aim of all public utilities, and to discourage and condemn such policies or aims as are unjust or unworthy.

4. No business transaction is, in the final analysis, satisfactory or profitable to either party to the transaction unless it is satisfactory or profitable to both, and every transaction should be made with this principle clearly in mind.

5. It is the duty of every public utility to take an active part in public affairs, in the interest of honest and efficient government, and to enable such utilities correctly to learn the needs of the community and to build intelligently to keep pace with its growth.

6. Public utility enterprises are honorable and worthy, and they afford distinct opportunities for individuals to serve society effectively.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Stokers and Furnaces.—The serial report of the prime movers committee of the N. E. L. A., is edited from the report of its sub-committee on stokers and furnaces. Three features in furnace development during the past year show great promise—the installation of furnace air preheaters, better combustion conditions by the mixing of furnace gases and the cooling of furnace walls by water or air. All of these are an aid in obtaining high boiler efficiencies. Test data on three furnace air preheaters are given. Considerable gains are reported by mixing the furnace gases from chain-grate stokers, thereby effecting better combustion. The construction of water-cooled furnace walls at four different stations, accompanied by test results of one boiler with such a furnace, is shown. The rate of coal burning on different types of stokers varies over a considerable range. Refinements in furnace construction overcome brickwork trouble. Interesting tests of refractories both as to size and physical characteristics are given. The developments in stoker design are included in the various manufacturers' statements.—*Publication No.* 24-72 *of the N. E. L. A.*

Davis Bridge Power-Plant Development of the New England Power Company.—E. B. COLLINS and H. R. WILSON.—An illustrated description, with map, stream profile, diagrams and data, of the most recent addition to the plants of the New England Power Company's system, involving an earth dam 200 ft. high, a circular spillway 160 ft. in diameter at the top and a hydro-electric installation of two (ultimately three) 20,000-hp. units.—*General Electric Review*, October, 1924.

How Much Work Can Be Obtained from a Pound of Fuel?—LIONEL S. MARKS.—An analytical discussion, with diagrams, of heat-engine cycles. The author holds that the Rankine cycle is no longer suitable as an ideal for steam plants because of the use of regenerative heating. He proposes a method of computation in which the actual temperatures of heat intake are taken into account, step by step.—*Power*, September 30, 1924.

Generation, Control, Switching and Protection

Frequency Changers.—K. LUBOWSKY.—Frequency changers which are intended for interlinking power systems at different frequencies are becoming more important, particularly in those countries where unification of frequency cannot be accomplished. There are two general types of frequency changers, namely motor generators and induction converters. The problems of control, load distribution and power transfer and a description of the two types of machines are included. — *Electrician (England)*, Oct. 10 and 17, 1924.

Oil and Gas Engines.—This paper is one of the serial reports of the prime movers committee of the N. E. L. A., taken from the report of the sub-committee on oil and gas engines. There have been few, if any, important changes in the development or use of oil and gas engines for central-station use in this country. Manufacturers are endeavoring to reduce the initial and subsequent costs of the solid-injection type of engines. Small improvements often greatly aid the lubrication problem. Periodic and systematic inspection of Diesel engines increases their reliability and decreases maintenance costs. In an endeavor to put oil-engine maintenance costs on a common basis a standard classification of accounts is presented. Diesel engine development in Europe is proceeding at a rapid pace. The use of the solid-injection type of engine is more noticeable, but for the larger sizes the two-stroke cycle seems to be preferred. Several new and interesting designs have been developed.—*Publication No.* 24-60 *of the N. E. L. A.*

Transmission, Substations and Distribution

Power-Circuit Interference with Communication Lines.—S. C. BARTHOLOMEW.—The author gives a general survey of the inductive-coordination situation and then discusses the factors in the modern generation and distribution of electrical energy which are responsible for interference with telegraph and telephone circuits, emphasizing the importance of harmonics in this connection and indicating some known remedies which may be applied to power plant at its source when the trouble is experienced. After discussing improvements and overhead power and telephone construction, he deals with the balancing of telephone circuits. In an appendix E. W. Marchant describes a method of removing ripples from mercury-arc rectifiers. With the appendix and the discussion, the paper is sixty pages long.—*Journal of the Institution of Electrical Engineers (England)*, October, 1924.

Electric Service from Rural Transmission Lines.—A. B. CAMPBELL.—This bulletin has been particularly prepared for distribution among farmers and those who are interested from the farmer's viewpoint in extending electric service from transmission lines and central stations into rural communities. Tables are given showing the sizes of motors most satisfactory for driving farm machinery and small household devices, and also on the consumption of the various electric heating devices. How electrical energy is carried to rural districts, plans followed in serving rural districts, how to proceed to obtain rural service, line material and line construction specifications, methods of metering and factors involved in the cost of rural service are among the topics discussed.—*Bulletin No.* 47, *Engineering Extension Department, Iowa State College*

Corona Losses Between Wires at Extra High Voltages.—C. F. HARDING.—Tests carried on at Purdue University indicate that at very high voltages Peek's formula gives values considerably in excess of those found by actual measurement. By working with an experimental line designed for 600 kv. it was possible to carry the investigation into a range of voltages much above those for which the empirical constants had been determined. Charts are presented showing results thus far obtained, with cables of three different sizes up to 500,000 circ.mil and with spacings varying from 18 ft. to 38 ft. The disparity between measured and computed losses is particularly noticeable in the case of the smaller conductors and the narrower spacings. The study is to be continued.—*Journal of the A. I. E. E.*, October, 1924.

Units, Measurements and Instruments

Harmonic Analyzer.—K. NOGUCHI.—A full description of a new type of the harmonic analyzer originated by the author is given with an actual result attained by analyzing an isosceles-triangular wave. By a friction-gear arrangement the instrument can be adjusted to fit any wave length from 0.5 cm. to 140 cm. and any wave height under 60 cm.—*Journal of the Institute of Electrical Engineers of Japan*, No. 433.

Formulas, Tables and Curves for Computing the Mutual Inductance of Two Coaxial Circles.—H. L. CURTIS and C. M. SPARKS.—The formulas for the mutual inductance of coaxial circles can be expressed either in terms of the radii of the circles and the distance between them or in terms of a parameter which is a function of these dimensions. Both types of formulas are developed in this paper and tables prepared to aid in the computation by each type. Charts are included from which an approximate value of the mutual inductance can be read directly. A number of examples are given to show the methods of computation by the different formulas, tables and charts.—*Scientific Paper No.* 492 *of the Bureau of Standards.*

Illumination

Studies in the Projection of Light.—FRANK BENFORD.—The present instalment is Part XIII of the long serial and deals with the design and characteristics of the double paraboloidal mirrors for searchlamps. For economy in manufacture the use of the paraboloid for the outer surface, rather than the exact optical mate of the inner surface, the co-paraboloid, is often preferable. A method of adjusting two paraboloids is developed and its accuracy is investigated. — *General Electric Review*, October, 1924.

New Lamp for Headlights.—A. MARSAT.—The author claims that comparatively very little attention is being paid to the shape and location of a filament in low-voltage lamps which are intended to be used in automobile headlights or on other illuminating apparatus where exact focussing is essential. If a lamp has to be replaced, the new lamp has to be readjusted in rela-

tion to the reflector, lens, etc., because its filament is not exactly in the same place. A new lamp is described in this paper which by means of a very exacting optical process permits the location of the filament in all lamps in exactly the same relation to the lamp base. In spite of its accuracy the process of assembling these lamps can be readily performed on a routine quantity production basis. The new lamps are in great demand by French automobile manufacturers and the Parisian traction systems.—*Revue Générale de l'Electricité*, October 11, 1924.

Motors and Control

High-Speed Direct-Connected Motors Demanded by Woodworkers. — W. A. FURST.—The electrical industry has kept step continuously with the advance and progress of woodworking machine-tool manufacture, and it has developed electrical equipment for the use of machine-tool builders whereby it has enabled them to obtain results that were impossible a few years ago. The recent development of individual motors on cutter heads, resulting in a call for 60-cycle current, is of particular interest.—*Electrical News*, Sept. 15, 1924.

Application of Motors and Control to Central-Station Auxiliaries.—H. L. SMITH. — The author considers each auxiliary in the steam plant separately in so far as various types of available drives are concerned. He discusses how the choice of motors should be governed by the reliability of service and by the simplicity and flexibility of operation. Circulating, condensate, vacuum and boiler-feed pumps, forced-draft and induced-draft fans and stokers are all described with particular attention to the motor that should be applied to each.—*Central Station*, October, 1924.

Starting Polyphase Synchronous Motors.—E. V. CLARK.—Although difficulty may ordinarily be experienced in starting up a polyphase synchronous motor simultaneously with the alternator supplying the circuit, the difficulty is greatly reduced if the alternator is of the asynchronous type. If the asynchronous alternator has a wound rotor and an adjustable rheostat in its rotor circuit, then the synchronous motor may be run up to speed by the operation of the rotor rheostat, with the asynchronous alternator running at full speed throughout. A scheme for operating small synchronous motors in a factory with this method of starting is outlined.—*Journal of the Institution of Electrical Engineers (England)*, October, 1924.

Heat Applications and Material Handling

Pipe-Welding Technique and Costs for Underground Pipe Lines.—H. A. WOODWORTH.—The author relates experiences covering sixteen years in the application of this method to making pipe joints. Valuable hints and instructions on how to make successful welds are given and characteristics of different materials and their effect on the welded joint are described. Efficiency of welded joints and factors affecting the efficiency are pointed out. Welding technique for underground construction and costs per weld for different sizes of pipe are also included.—*National Engineer*, September, 1924.

Minimal-Length Arc Characteristics. H. E. IVES.—Evidence is presented that the discharge occurring between separating electrodes is, for large currents, an arc; for small currents, an atmospheric spark. A method for isolating the arc discharge for study is described. Arc characteristics for arcs of extremely short length have been experimentally obtained. The relationship of these minimal-length are characteristics to finite-length arc characteristics is discussed. The minimal-length characteristics are then used to develop an expression for the voltage-current-time relations in break arcs.—*Journal of the Franklin Institute*, October, 1924.

Electrophysics, Electrochemistry and Batteries

Effect of Fatigue on Magnetic Properties.—The statement has often been made that the progress of a fatigue failure in steel caused by repeated stresses is accompanied by a corresponding change in magnetic properties. In view of the fact that there is no record of any experimental verification of this statement, the bureau is undertaking the study of the effect of fatigue on the magnetic properties of steel. Preliminary experiments have been made using a rotating beam machine of the Farmer type, but as this machine appears to be unsuitable for the purpose a Haigh alternating-stress machine has been obtained for this work. This investigation is a part of a more comprehensive program for the investigation of the possibilities of magnetic analysis for the nondestructive testing of wire hoisting rope.—*Technical News Bulletin No. 90 of the Bureau of Standards.*

Throwing Power, Cathode Potentials and Efficiencies in Nickel Deposition.—H. E. HARING.—The throwing power of nickel solutions was determined by means of apparatus that has previously been described before this society. The cathode potentials and efficiencies during nickel deposition were measured. The results show that the chief factor in throwing power in nickel deposition is the cathode efficiency. This is determined principally by the ratio of the effective nickel and hydrogen ion concentrations in the cathode film. All conditions which increase this ratio improve throwing power.—*Paper presented before American Electrochemical Society, Detroit*, October 2-4, 1924.

Traction

Electrification of the Spanish Northern Railway.—A. I. TOTTEN and H. C. HUTCHINSON.—An illustrated description of the 3,000-volt direct-current electrification of a 38-mile section, the initial step of an extensive program. The present undertaking runs from Ujo, about 35 miles from the port of Gijon on the Bay of Biscay, over the mountains to Busdongo. It includes numerous tunnels and curves, as well as a continuous 2 per cent grade 30 miles long. The locomotives are electro-pneumatically controlled, have six motors designed for operation three in series, weigh 179,000 lb. and have a continuous rating of 1,550 hp. for a temperature rise of 120 deg. Regeneration is accomplished by using one motor to excite its own field and those of the other five, which are connected in series and feed into the line. The article also describes the substations and the twin-catenary overhead line construction.—*General Electric Review*, October, 1924.

Power Facilities in the Railway Field. —C. H. JONES.—The power requirements of the electric railway now form a comparatively small part of the total demand in the average community. This favors the purchase of power from the central station, but the correct power contract is important to protect the railway. Outstanding developments in power distribution are the automatic substation and supervisory control systems now being applied on a large scale in this field. — *Electric Railway Journal*, September 27, 1924.

Western Australian Government Electricity Supply and Tramways.—W. H. TAYLOR.—The author gives first a description of the generating and railway electrification systems in Australia, followed with the actual operating results for the last year. — *Electrical Times (England)*, October 2, 1924.

Telegraphy, Telephony, Radio and Signals

Radio Publications of the Bureau of Standards.—The radio publications of the Bureau of Standards printed at the Government Printing Office can be secured by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C. This circular gives the list of all the government radio publications and also gives references to articles emanating from the bureau which have been published in outside periodicals.—*Letter Circular No. 40 of the Bureau of Standards.*

New Theory of Long-Distance Radio-Communication. — G. W. O. HOWE. — Basing his discussion on measurements recently made on a French cruiser during a voyage in the Pacific, which indicate a pronounced focus at the Antipodes, the author traces the path of the energy in the spherical shell between the earth's surface and the Heaviside layer. Since the constants are unknown, the attenuation cannot be computed in advance, but from the observed variation in the intensity of the signals the reverse operation may be possible. However, much of the energy radiated strikes the layer at an angle approaching the normal and is largely absorbed or reflected toward the earth. Only the fraction that strikes it tangentially remains to be guided around. The problem is to determine its magnitude and to compute its attenuation. The author develops a formula for the electric field strength involving this fraction j, the height of the sending aërial and the current in it, the wave length, attenuation factor, the distance d and the angle at the earth's center:

$$E = \frac{386}{10^3}\,\gamma \cdot \frac{h_1 I}{\lambda} \cdot \frac{\epsilon^{-\beta d}}{\sqrt{\sin\theta}}$$

—*Electrician (London)*, Sept. 12, 1924.

New Books

Electrical Measurements in Theory and Application

By A. W. Smith. Second edition. New York: McGraw-Hill Book Company, Inc. 338 pages, 203 illustrations. Price, $3.

This book is a revision and enlargement of the "Principles of Electrical Measurements" and is written for those who have taken one year of college physics and desire further knowledge regarding electrical and magnetic matters. Emphasis is placed on the fact that the electron theory of electrical phenomena should be presented to all students of physics and electrical engineering. Regarding the electron tubes used in traffic communication, for instance, there is no doubt that the stream of electrons through the tube continues as an electron current through the connecting wires. This point of view has been taken throughout the book, and electrical currents are considered as the flow of electrons along the circuit.

The strict definitions that establish the magnitudes of the various electrical units show that the author has a very intimate knowledge of his subject. Graphical methods have been introduced freely for the solution of inductance and capacitance bridges. They are used to supplement the analytical methods and give a clear insight into the relations of the currents and electromotive forces in the various circuits.

Applied Electricity for Practical Men

By A. J. Rowland. Second edition. New York: McGraw-Hill Book Company, Inc. 430 pages, illustrated.

This very clearly written text for practical electrical workers has been completely revised and brought up to date. Good illustrations, illustrative problems and the direct application of principles to practical work are features of the revised edition which will continue to make it one of the most popular practical texts.

Elements of Electrical Engineering

By A. L. Cook. New York: John Wiley & Sons, Inc. 554 pages, illustrated.

An elementary textbook for college students which covers the general principles of electrical engineering and applies them to familiar machines and circuits. Both alternating-current and direct-current circuits and equipment are treated in a series of short chapters, each of which is illustrated and is followed by a group of problems. The magnetic circuit is treated in greater detail than in similar texts covering the same field, and the author utilizes vectors instead of the complex variable in treating polyphase alternating-current circuits. A brief treatment of transmission and motor application is included. The text compares very favorably with others designed for a short course in electrical engineering and is written so as to be used conveniently and easily by teachers and students. It follows the very general opinion that breadth and scope rather than thoroughness and completeness are essential to a first course in electrical engineering. When this type of text is used it is customary to adopt a more advanced text later in the course to review and fix the principles in the minds of students.

Substation Operation

By Edwin Kurtz. New York: McGraw-Hill Book Company, Inc. 261 pages, 207 illustrations.

An elementary textbook giving the principles as well as the methods of substation operation in which every effort has been made to present the needed information in an easily understood manner. The presentation of electrical theory is confined to a few fundamental ideas. The descriptions and explanations of principles of operation of machines and auxiliary apparatus are stated as simply as possible. Much material, such as the chapter given over to the care and use of safety equipment, principles of safety, first aid, methods of testing circuits, etc., is generally not available to operators at all. Another chapter gives detailed information on the use made of station readings and records and how operating results are calculated from them. The section on test questions for substation operators should be very valuable in determining whether a person is qualified to operate a substation or whether an operator is qualified for promotion from one grade to another.

The Electron

By Robert Andrews Millikan. Chicago: University of Chicago Press. 293 pages, illustrated. Price, $1.75.

Divided roughly into three parts, the contents of this volume are (1) an account of the history of electrical theories from Benjamin Franklin to Johnstone Stoney and J. J. Thomson; (2) a description of the author's oil-drop method of determining the magnitude of the electron (e) with its corollary, the proof of the atomic nature of electricity and a discussion of the probable structure of the material atom, and (3) a consideration of the nature of radiant energy as an outstanding problem of physics.

To make it useful not only to the physicist but to the reader of less technical training, the material has been presented in a semi-popular style. Moreover, it has been thought desirable for the sake of both classes of readers not to break the thread of the discussion in the body of the book with the detailed analysis which the careful student demands. For this reason all mathematical proofs have been thrown into appendices. The work consists of ten chapters with nine appendices and is well indexed both as to author references and subjects discussed.

Industrial Electricity

By Chester L. Dawes. New York: McGraw-Hill Book Company, Inc. 371 pages, illustrated.

Because of the rapid increase in the industrial applications of electricity having resulted in the establishment of elementary electrical engineering courses in many technical high schools and other schools not of collegiate grade there has been an insistent demand for textbooks suitable for such courses.

Throughout the volume here under notice the attempt has been made very successfully to explain in simple language the principles underlying electrical engineering and apparatus. It gives a bird's-eye view of electrical engineering and its problems to the student who is beginning to study the subject either by himself or in courses of the grade of those found in technical high schools.

It takes up and explains in considerable detail magnets and magnetism, electromagnetism, resistance, Ohm's law and the electric circuit, battery electromotive force, primary and secondary batteries, storage batteries, electrical instruments and measurements, the magnetic circuit, electrostatics, capacitance, the generator and its characteristics, the motor, energy losses, efficiency and operation. Sufficient theory and descriptive matter are given to enable the student to understand the phenomena which he may be called upon to analyze in connection with industrial apparatus.

A large number of illustrative problems are given to show concrete applications of principles. The book has a useful appendix of tables, and it is also supplemented with questions and problems on each chapter, which is particularly advantageous to the student who is taking up the subject by himself.

Electric Railway Transportation

By H. W. Blake and Walter Jackson. Second edition. New York: McGraw-Hill Book Company, Inc. 435 pages, illustrated.

The changes in the electric railway industry since the first edition of this well-known work in 1917 have resulted in its complete revision. The changes in fare conditions, the advent of one-man cars and of motor buses and other developments in the art of transportation have been treated fully in the new edition, and it is certain to be well received by the railway industry and the colleges.

Books Received

Dictionary of Electrical Terms. By S. R. Roget. New York: Sir Isaac Pitman & Sons, Ltd. 296 pages. $2.25.

Automatic Telephone Systems. By William Aitken. Vol. III. New York: D. Van Nostrand Company. 339 pages, illustrated.

Strowger System of Automatic Telephony. By H. H. Harrison. London: Longmans, Green & Company. 146 pages, illustrated.

Electrical Drafting and Design. By Calvin C. Bishop. New York: McGraw-Hill Book Company, Inc. 165 pages, illustrated. $2.

Electric Railway Practices. New York: American Railway Association. 221 pages, illustrated.

Railroad Commission of Wisconsin. Second Report on Water Powers, 1914-1923. 575 pages.

News of the Industry

The General Election and the Utilities

Satisfaction Is Felt by the Electrical Industry in Proof Afforded that Public Ownership Has Gained No Real Grip on the Voters

IN COMMON with other public utility men, those engaged in the electrical industry express very general satisfaction with the trend of public thought as evidenced in the results of the national and state elections last Tuesday. Fears expressed in some quarters that the third party headed by Senator La Follette, with its open declaration for public ownership and operation of utilities and its extravagant claims of public benefit to result therefrom, especially as regards the development of water power, would poll a vote great enough to throw the election of a President into Congress proved entirely unfounded. With the failure of the so-called Progressive party to play the large part prophesied for it there disappears, for the present at least, much of the driving power behind its radical propaganda, including its proposal that decisions of the Supreme Court of the United States declaring acts passed by Congress unconstitutional should, by constitutional amendment, be subject to overthrow through the re-enactment of the measures. It is safe to say that little will be heard in the next four years of this proposed constitutional change, which was opposed determinedly by both the old parties. Clamor for federal, state and municipal ownership and operation of utilities is likely also to die down, and the utility companies will find less uninformed and purely political opposition and will have an improved opportunity to demonstrate the superiority of private ownership under government regulation and to reap the benefit in good feeling and conservative thinking that come from the widespread distribution of utility securities among the public.

President Coolidge's Position

President Coolidge's great majority makes him the undisputed actual as well as titular leader of his party. There is no doubt whatever as to his thoroughgoing opposition to public ownership in every form. He has made this clear on many occasions and emphatically in his addresses to public gatherings and over the radio during the campaign just closed. His last utterance save one by the latter medium was broadcast on October 23 to the enormous, if invisible, audience that radio has made it possible to assemble. In it he dwelt on the crushing load of debt and consequent taxation that public ownership would involve and the almost despotic power it would put in the hands of the government, saying on this subject, among other things:

"It has always been the theory of our institutions that the people should own the government and not that the government should own the people. This policy cannot be maintained unless the people continue to own and control their own property. The most important property of the country is transportation and water power. It is not only very large in amount, but is of the greatest strategic value. It could be used in such a way as to assume virtual control of all other business of any importance. It is proposed that these properties should be brought under public ownership. Responsible public commissions have valued these at about thirty-five billion dollars. Such a cost would more than double all our public debts. Any deficit in earnings would have to be made up out of taxes. With the government in possession of such a great engine, with two and three-quarters millions of employees, spending nine or ten billion dollars each year, holding virtually the power of life and death, what chance would the rest of the people have?"

Pacific States Reject Public Ownership

California Again Slaughters Water and Power Act—Washington Overwhelms Bone Bill—Klamath River Measure Carried—Hunt Probably Re-elected

APART from its concern with the general results of the national election, the electrical industry had a special interest in four matters that came before the voters in the Far West. These were the resubmission by initiative in California of the water and power act, the initiated measure known as the Bone bill which was referred to the voters in the State of Washington, the proposed prohibition of power development on the Klamath River in north California, also an initiated measure, and the gubernatorial election in Arizona.

Water and Power Act and Bone Bill Both Swamped

Of these contests, the most important was that in California over the water and power act, which, as readers of the ELECTRICAL WORLD know, was designed to amend the state constitution so as to bond the state for half a billion dollars for the purpose of launching into a state-wide public ownership program of water-power development. This measure was defeated on its first submission two years ago by more than 350,000 votes, or much better than two to one. On Tuesday it went down to defeat by a majority that promises, when all the returns are in, to be nearly as great—a gratifying evidence that the first vote was not a snap verdict but represented the reasoned conclusions of the people.

Complete returns from 4,500 out of 7,500 precincts in the state give the vote as 197,900 for the act and 395,300 against it. If this ratio holds, the bill will be defeated two to one. A telegram received by the ELECTRICAL WORLD Thursday morning as it goes to press says that San Francisco has gone about two to one against the act and Los Angeles about four to one.

Second in importance was the Bone bill submitted in Washington, which was intended to give cities and towns the right to purchase and sell electrical energy inside or outside their corporate limits and to acquire or construct electric generation, transmission and distribution systems. This bill, too, met with crushing defeat. Even in Seattle, which was the headquarters of the agitation and where it was argued that the bill would give a needed outlet for power from the Skagit municipal system, the measure was beaten decisively. A telegram received Thursday morning says:

"The Bone bill has been beaten in every county of the state, with the possible exception of Clallam and Kitsap. Defeated in Seattle by six thousand votes. Tacoma neck and neck. Estimated majority against bill between sixty and eighty thousand."

Returns from 1,225 precincts out of 2,437, the total number, give a vote of 75,366 for the bill and 109,631 against it.

The Reed bill, which was passed by the Legislature in 1923 for reference to the electorate, was also defeated, apparently by three to one, 22,501 votes for it and 63,151 votes against it being reported from 473 precincts. This bill provided for a state tax of 5 per cent against the gross revenues of the light and power business of any municipality selling power outside of its corporate limits.

Klamath River Bill

The Klamath River bill was sponsored by the California Fish and Game Commission to prohibit power development for all time along virtually the entire length of the river, creating there a fish and game district. This proposal was based on the contention that high dams will bring destruction to the salmon industry because the fish cannot

ascend them to reach the spawning grounds. The Federal Power Commission had granted a preliminary permit to the Electrometals Company for two dams in this river, the commission hoping that a solution of the fish problem—on which experts are working on the Columbia River—would be reached by the time the company was ready to erect the dams. The power interests have, however, suffered a decisive defeat in the election. The same 4,500 precincts whose vote on the water and power act is given above registered 260,000 for the bill prohibiting development on the Lower Klamath and 172,000 against it, and the same ratio is expected to hold when the entire vote is tabulated. A map of the Lower Klamath River, on which the power resources are estimated at approximately 500,000 hp., will be published in "News of the Industry" next week.

ARIZONA'S ELECTION

The importance of the Arizona election to the electrical industry lies in the part played in it by the seven-state treaty for the development of the Colorado River. This treaty, accepted by the United States government and by Colorado, California, Nevada, Utah, Wyoming and New Mexico, was rejected by Arizona under the leadership of Governor G.W. P. Hunt. Mr. Hunt ran for re-election as the candidate of the Democratic party and based his campaign in large part on his opposition to the treaty. His Republican opponent, Dwight B. Heard of Phoenix, accepted the compact with certain reservations referred to in the ELECTRICAL WORLD for September 20, page 651. Returns received as the paper goes to press show a probable victory for Governor Hunt. A dispatch sent from Phoenix late Wednesday night said:

"Governor Hunt was returned to office to serve his fifth term, according to indications in returns tabulated tonight from 406 precincts out of 484 in the state, which gave to him a majority of 976 votes over Heard. The figures tonight were: Hunt, 36,789; Heard, 35,813."

New York State and Water-Power Development

Away from the Pacific Coast, water-power development plays a bigger part in the political talk of New York than of any other state. Governor Alfred E. Smith has long advocated public ownership and operation of the remaining water powers in the state, including future use of the Niagara and St. Lawrence Rivers. His party's policy has, however, lacked clear definition, as has also that of the Republican party, and the question has become a football of politics, with the proposed legislation of one party defeated by the other and conditions remaining in the unsatisfactory *statu quo* where the creation of the state water-power commission under Governor Miller and its subsequent inaction under Governor Smith left them. The vast personal popularity of the Governor, especially in Greater New York, has again brought him a handsome victory, despite President Coolidge's enormous plurality in the state; but inasmuch as both House and Senate will now be Republican, it looks as if the deadlock on water-power and utility legislation of importance will continue. Only the unlikely contingency of the Legislature passing bills that the Governor will approve can break it.

Intensive Water-Power Development on the Peshtigo

Announcement by J. P. Pulliam, general manager of the Wisconsin Publis Service Corporation, that this company has applied to the Railroad Commission for a permit to build a fifth water-power plant on the Peshtigo River draws attention to what will eventually be an extraordinarily efficient hydro-electric development; for when all the company's projected plants are in operation the corporation will be using the waters of the Peshtigo River seven times within a distance of 40 miles and with a total river fall of 369 ft. Moreover, most of the stations will be automatically controlled, thereby requiring the services of only one man for each automatic station.

Mr. Pulliam said that the Wisconsin Public Service Corporation had purchased a site of about 180 acres at Sandstone Rapids, about 3 miles north of Crivitz. Construction work is to be started at once. Purchase of the site and the building of a dam and hydro-electric plant will entail an expenditure of $1,000,000. Mr. Pulliam also announced that the company had purchased the hydro-electric plant of the Crivitz Pulp & Paper Company from the Hoberg Paper & Fiber Company, Green Bay. This plant is now used to operate a pulp mill and for a time will continue to be operated as such under a lease to the paper company, but the Wisconsin Public Service Corporation plans to rebuild and enlarge the plant at some future time.

With the erection of the plant at Sandstone Rapids, the Wisconsin Public Service Corporation will be using the waters of the Peshtigo River four times within a distance of 20 miles. The other plants are at Cauldron Falls, which is the furthest upstream and is expected to be placed in operation at the end of November; High Falls, 8 miles down stream, and Johnson Falls, 4 miles further down. Sandstone Rapids is 8 miles below Johnson Falls. In addition to these plants the corporation also owns and operates a hydro-electric power station at Peshtigo. It owns, too, another site between Johnson Falls and Sandstone Rapids, called Seymour Rapids, which will be developed at some later time. The new station at Sandstone Rapids will be of automatic type.

Power Bureau of Los Angeles Plans Improvements

A seven-million-dollar improvement program for increased substation and distribution facilities in industrial areas has been announced by the Bureau of Power and Light of the city of Los Angeles. This money is to be spent over a three-year period and will, it is estimated, provide for an additional 140,000 hp. by 1927. Work has already started on a new substation at Mateo and Hunter Streets which will cost $200,000 and have a distributing capacity of 50,000 hp.

Included in the development program are the following improvements: East Los Angeles, for substation facilities, enlarging and extending power lines, $960,000; Santa Fé-Southeast industrial area, general enlargements and extensions, $1,400,000; South Park industrial district, power-line enlargements and extensions, $1,100,000; San Fernando Valley, greatly increased facilities for heavy power service, $1,200,000; Florence Avenue and "Shoestring" district, extensions and improvements to heavy power service, $700,000; harbor district, extending and enlarging power service facilities to meet requirements of waterfront industries, $1,350,000.

All of these added facilities are to care for the rapidly increasing industrial load on the municipal system, and they do not include extensions and betterments being made to meet growing power and lighting requirements of domestic and commercial consumers.

Home-Lighting Contests Report High Enrollment

High enrollment by the school children in the home-lighting contests is being obtained by virtually all of the communities that have reported the results of the contest to the Lighting Educational Committee. The percentage of school children entering the contest to those who are eligible ranges from 35 to 75 on the first returns. The percentage of enrollment is especially high in those towns that have school indorsement and that are distributing the primers through the schools, but in the larger cities where the school boards have not wished to give school time to the movement good results are also being obtained.

In San Francisco, for instance, the schools would not co-operate in the distribution of primers, so arrangements were made with one of the large banks to give out the primers at each of its branches, which are scattered throughout the city. Excellent results are being obtained in this manner. In New York four trained girls were present at the Electrical Exposition to register the many children who visited the show.

Montreal now announces an organization that will completely cover the city. All of the electrical interests there have contributed to the contest and wide interest is manifested. Portland, Ore., reports complete success. Distribution of the primers was made through seventy-eight public schools.

Plans are now being made by the Lighting Educational Committee to judge the winners of the local prizes. All local contests will be completed by December 1, and the primers and essays of the winners must be in New York by December 15. International examination will begin as soon as the winning primers begin to arrive, and the international judges will meet in New York on December 29 to make the final decisions.

Uses of Electric Welding

Fabrication of Steel by This Method Discussed at American Welding Society Convention

A VERY interesting program of technical papers and inspection trips marked the fifth annual meeting of the American Welding Society, held in Cleveland on October 30 and 31. The convention was attended by nearly one hundred welding and structural-steel engineers. The technical session was devoted primarily to welding and cutting processes as applied to the fabrication of large structures, such as cranes, bridges, buildings, etc.

In a combined paper by H. Goldmark, W. Spraragen and W. L. Warner electric arc welding as a method of fabricating large structures was considered. It was shown from data taken from existing examples of structural-steel applications that had been welded that the electric arc method of fabrication saved from 15 per cent to 25 per cent in weight of steel used as compared with a riveted structure. The welded joints may easily be as strong as the parts themselves, while the corresponding riveted joints are rarely equal to 75 per cent of the strength of the parts.

The elastic features of the welding process commend it for this class of work. Sometimes the welded joint may necessarily be so situated that the weld as laid out by the draftsman cannot be completely made owing to interference from other members or a similar obstacle. In that case the weld may be shifted somewhat or an extra plate added without appreciable delay or increased weight and cost. With a riveted member considerable time and cost would be necessitated in preparing an additional gusset plate and riveting it. With welding structures simpler drawings can be used, certain steps such as the making of templets, marking steel, punching or drilling holes and painting can be eliminated, accurate alignment is not necessary, noise is eliminated, a saving in freight and handling is effected on account of the lesser weight of material involved, and the resulting product itself is claimed to be superior to a riveted structure.

A combination of the above factors makes it possible with the use of weldings to produce a structure cheaper and better than one made by riveting. The designing is more easily and quickly done. The only shop work is that for cutting the gusset plate and members to the proper size. Assembly and erection are more easily and quickly carried out, and there are few delays or possibilities of delays caused by errors in laying out the work.

Discussion of this paper showed that there was a great deal of optimism as regards increase in the fabrication of structures by the arc method. In order to make the most rapid progress, it was emphasized that the American Welding Society and the structural steel engineer must get together to work out the problems encountered.

MENTAL RESISTANCE ENCOUNTERED

At present three million tons of structural steel are used under strain, according to E. H. Miller. With each ton an average of 150 rivets is used. The structural engineer knows exactly what the rivets will do and must be shown what happens when the rivets are replaced by welds. The structural engineer wants the weld only as it reduces his cost. In Mr. Miller's opinion, the cost of making proper tests of welds will exceed the cost of the welds, a factor which must be considered. He concluded by saying that the mental resistance of the structural-steel engineer has to be overcome before very much can be accomplished.

In an appendix to the paper presented W. L. Warner discussed the design of welded trusses and compared them with similar trusses that were riveted. The greatest economy will result only when the truss or structure is designed for welding in the first place instead of designing it for riveting and then redesigning for welding. As the art of welding becomes more and more an important factor in the structural-steel fields, standardized designs will be evolved which will render the design of welded structures more simple.

Question was raised as to what method of welding should be used, as the joints may be made by one of several methods. A committee is to be formed that will take this subject up with the purpose of comparing the performance of the various methods based on a similar application.

WELDED-JOINT CHARACTERISTICS

The use of the electric arc for welding structural steel with particular reference to the characteristics of the welded joints was discussed in a paper by R. E. Kinkead. He first considered the reasons why rivets worked loose. Millions of dollars are expended every year maintaining structures on which this happens. To avoid the loosening of rivets he suggested the application of welding for the joints. However, he added, there are a great many things that must be investigated. Only the lack of a physical conception of what actually happens when a load is applied to a structural-steel beam or column is in the way of applying welding to this work, and it is a relatively short step to obtain this information.

The use of spot welding in the structural field was described by H. A. Wooster. He showed that already there are a variety of applications. Insurance companies, national inspection boards and railroad and steamship officials have recognized and approved the spot-welding processes in many instances. Definite data now exist regarding the power demand and showing the saving and cost of labor and material. Large spot welders have been and can be built with high power factor and efficiency and of either stationary or portable types.

Street-Lighting Tables for 1925

FOLLOWING its practice for thirty-six consecutive years, the ELECTRICAL WORLD is preparing tables showing the proper time for lighting and extinguishing street lamps. The tables for 1925 will be ready November 15, and a copy of them will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

Receivers Appointed for Colorado Springs Company

For the purpose of giving the bondholders of the Colorado Springs Light, Heat & Power Company title to the company's property so that they can deliver its city distribution system to the municipality in accordance with the agreement arrived at (see ELECTRICAL WORLD for August 16, page 329), the United States District Court at Denver has appointed J. Frank Dostal, general manager of the company, and Ivor Wingren, a Denver attorney, to be receivers. Until the survey is made and submitted to the court there will be no change in personnel or policy, except that O. F. Lackey, vice-president of the company, will probably be transferred to another position by the United Gas & Electric Corporation, the controlling concern. The question of the disposition of the company's distribution system outside the city and of its gas system has not been settled, and the bondholders are still negotiating with the city in an effort to get it to take over all the property of the company.

Commercial Section of Pacific Coast Association

The first meeting of the year of the Commercial Section of the Pacific Coast Electrical Association was held at Los Angeles, October 17-18. Work of the sub-committees for the ensuing association year was outlined by the various bureau chairmen. The Appliance Bureau will make no survey of appliances in use at this time, but will devote its efforts to the furthering of appliance sales and the devising of ways and means of sales promotion and development. The preparation of a manual for employees will occupy the time of the Customers' Relations Bureau. A study of metered water heating will be the chief activity of the Electric Cooking and Heating Bureau. The work of the Lighting Bureau will be threefold. Its attention will be devoted to the home-lighting contest, a lighting school and a co-operative farm-lighting plan. The Power Bureau will undertake a survey of present and possible uses of electricity in agriculture and the utilization of waste heat in cement plants, laundries and sawmills. The work of the industrial heating and electric truck sub-committees will be carried on along the lines of the work last year.

There were sixty-seven in attendance. The Commercial Section will hold its next meeting at the same time as the meeting of the Commercial National Section, N. E. L. A., at San Rafael, Cal., November 19-21.

Discuss Street Lighting and Traffic Control

Final Day's Session at the I. E. S. Convention Also Hears that Glare May Be Reduced to Practical Calculation— "Cold-Light" Efficiency Dream Shattered

STREET lighting and traffic control occupied the attention of the Illuminating Engineering Society at the Thursday morning session of its convention at Briarcliff Lodge, Briarcliff Manor, N. Y., last week. The earlier sessions of this convention were reported in the ELECTRICAL WORLD for November 1, page 961.

J. F. Meyer of the Bureau of Standards reported on a survey of street-lighting practice in the United States conducted by the bureau in cities of between ten thousand and five hundred thousand population. In all, 730 cities were included in the plan for the survey, half of which furnished engineering and statistical data. Mr. Meyer presented extensive tables showing ranges of illumination, kind of equipment, average cost at different illumination levels and other available information. In the larger cities 60 per cent of street lighting is by arc lamps, whereas in the smaller cities the figure is only 20 per cent. The highest average annual cost reported is $708 per mile of street, and the highest average cost per capita per year is $1.02. In the discussion it was pointed out that this survey shows an unwelcome low average of street lighting for the entire country, and a definite proposal was made that a proper lighting plan for any given city should be placed in the hands of a committee in that city to use as its own and to form an ideal for the city to work toward. This was suggested as better commercial practice in street lighting than to try to work at plans piecemeal and indiscriminately through aldermanic committees.

Considerable discussion arose over the results of the Columbus street-lighting tests, a report on which was made by Prof. F. C. Caldwell. He reminded his hearers that four manufacturing companies directed a commercial demonstration of residence, boulevard, business and "white-way" lighting in Columbus. Comparative tests of the various methods of lighting shown, together with a personal analysis of the situation, formed the basis of Professor Caldwell's paper.

Ward Harrison pointed out that from the psychological standpoint it was well worth while to have an example of really good lighting in any city. If the people decide they cannot afford the best, they will cut it down; but they will probably not cut it down so much as they would if only an average lighting installation were originally made. It was further pointed out in the discussion that illumination readings play a small part in decisions on street lighting today, since many other factors, such as glare, appearance, etc., enter into the problem.

TRAFFIC CONTROL AND LIGHT

A striking paper which called forth much comment was one on traffic control systems by C. A. Halvorson, Jr. Mr. Halvorson discussed the present problem of traffic control, with its increasing complexities, and showed how necessary it was to depend upon electric light for traffic signals. He also put forward various ideas with reference to the color and form of signals, as well as simplifications of electrical design and control, in order best to handle the traffic in urban communities. It was emphasized that this is becoming such an important feature of electrical service that central-station men are necessarily studying traffic control, and the contention was made that traffic control signals will soon be as necessary as street lighting and will ultimately play as important a part in the relation of the central station to the community.

Another interesting contribution to this subject was made by Dominick Henry, Deputy Police Commissioner of the city of New York in charge of traffic control.

In reporting on the work of the committee on educational courses, which conducted a joint N. E. L. A. - I. E. S. course this fall, Ward Harrison commended the publicity work and technical papers of the I. E. S., urging that more use be made of them by "broadcasting." He said that at the present time there are no "receiving stations" to report results from their distribution. One of the principal things which the members of the course learned was how lighting service departments are run.

A short-cut design for electrical signs was presented by C. A. Atherton, who pointed out that the size of many signs is determined largely by guesswork, whereas location, the number of people which it is desired to reach and various other factors taken into account in the right way would assist in determining the most economical size of the sign to erect at any given point.

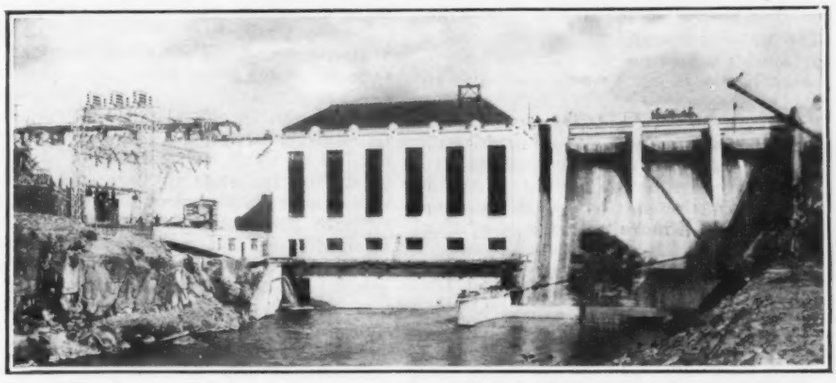
GLARE AND VISIBILITY

A paper on "Glare and Visibility," by M. Luckiesh and L. L. Holladay, marked a great advance in the analysis of this troublesome and evasive subject. In other words, this paper made a distinction between glare and visibility, showing what each is. It also analyzed glare quantitatively as well as qualitatively. The accomplishment was best summed up by Ward Harrison, who said that when investigation starts on a given subject it continually gets more and more complex the more there is learned about it. Finally, however, the subject begins to simplify, and Mr. Harrison welcomed this paper as the first and at the same time a great step toward simplifying the study and analysis of glare. It will soon be possible to calculate glare just as effectively as foot-candle illumination is now calculated, he declared.

In his paper on the "Meaning of Speed of Vision" P. W. Cobb gave results of investigations which indicate progress toward the determination of this problem, but said that there is still a great deal of uncertainty remaining as to what "good vision" means.

In discussing the "Luminous Efficiency of 'Cold' Light," E. Q. Adams showed that the actual efficiency of the glow of phosphorus is less than one

Utah Power & Light Company's Soda Point Plant



WORK has been completed on the Utah Power & Light Company's power development at Soda Point, on the Bear River, near Alexander, Idaho. This new plant, with an installed capacity of 14,000 kw., is now operating as a part of that company's hydroelectric system. Actual construction work on the project, with the constant employment of about six hundred men, has been under way for the past year and a half. Preliminary engineering work and drilling for bedrock began in the summer of 1922.

Two vertical units (General Electric) of 7,000 kw. each, with Allis-Chalmers turbines, are installed in this plant, and its construction throughout embodies the most advanced features in engineering design. The dam is 80 ft. in height above the water surface and about 110 ft. above the deepest part of the foundation. It is 518 ft. long across the top and contains about 45,000 cu.yd. of concrete. At the bottom it has a thickness of 80 ft. and at the top 10 ft. The storage reservoir is about five miles long and averages three-quarters of a mile in width. At its maximum high level it will extend to a point opposite the town of Soda Springs. This reservoir contains about 12,000 acre-ft. of water and becomes an important secondary storage reservoir to augment that of Bear Lake, thus increasing the advantages to be gained through water conservation and equalization of stream flow.

one-thousandth of the luminous efficiency of the "Mazda" lamp. With reference to the firefly and its cold light, Dr. Adams concluded that, although it is probably more efficient than phosphorus in the production of light, yet because of the total amount of heat which the firefly must radiate to accompany its light, its efficiency is still very much below that of the lamp.

The convention closed on Thursday night with the annual banquet, at which there was a delightful address by Prof. Charles Fabry, professor of physics at the University of Paris, who had spoken at the afternoon session on the "Connection Between Astronomical and Practical Photometry."

As announced last week, the attendance at this convention broke all previous records. Three hundred and sixty-one were registered as compared with 309, the highest number recorded in any previous year.

N. E. L. A. Technical Men Adopt Program

Large and Representative Attendance at St. Louis Meetings of Section —Divisional Committees to Be Strengthened Without Weakening Those of National Body

ALMOST identical recommendations for more effectively and efficiently conducting the national and divisional technical activities of the National Electric Light Association emanated separately yet almost simultaneously from the conference of N. E. L. A. divisional chairmen and from meetings of the various technical committees and the Technical Section executive committee held lately at St. Louis. All concerned—whether they were divisional or national representatives—were in accord regarding the manner in which their activities can be carried on with the least expenditure of time and money and still with increased benefits to all members of the N. E. L. A.

The machinery for accomplishing these results was based on the 1920 revision of the N. E. L. A. constitution, but the meetings just held marked the first tangible steps in the application of the plan formulated four years ago. The need of making some definite application has been discussed in small groups here and there for some time. The unanimous and apparently sudden action by divisional and national representatives was due in no small measure to the leadership of Technical Section Chairman H. P. Liversidge and to the hearty response of all group-meeting representatives to his earnest request that they formulate specific procedure for carrying on national and divisional activities in a more unified and efficient manner.

The plan voiced on every hand is intended to augment the value of every divisional and national committee and to extend the benefits from their activities to the industry as a whole—small, medium and large companies alike. It is likewise intended so to co-ordinate the work of divisional and national committees that regional as well as widespread results may be achieved with the least expenditure of time and money. Neither divisional nor national committees will lose their identity. If anything, the divisions will be strengthened and the national committees afforded a better opportunity to expand their field of usefulness and to eliminate and prevent duplication of effort. No complications in organization structure are injected, the existing divisional and national organizations being retained *in toto*. Continuous performance is more strongly assured than ever both as to committee personnel and publication of information in serial reports.

The procedure will take advantage of the more intimate contact which divisional committees have with member companies and individuals. Besides this, it will afford an opportunity for less-known but nevertheless highly able men to take active part in committee work and will more forcibly attract the most able men to chairmanship of committees because of the distribution of detail work and the consequent greater opportunity for constructive thought.

Already the divisional organizations parallel in structure that of the national body. By constitution, the divisional Technical Section chairmen are members of the Technical Section executive committee and the divisional committee chairmen are members of the corresponding national committees. Because of the large attendance of divisional representatives at the St. Louis meeting and the close personal ties which have been established by all committees there is every assurance that the decisions as to subdivision and distribution of work will be handled in a most agreeable and effective manner.

In order still further to establish co-ordination and continuity of purpose it is tentatively planned that at the end of each administrative year the chairman of each divisional and national committee will include in his annual report an outline of work that should be carried on during the ensuing year. This plan will enable divisional committees to anticipate the work they will be called upon to do and will thus facilitate their getting it under way with the beginning of each administrative year.

BETTER CO-ORDINATION

With the new plan the divisional committees will be supreme in their own territories, retaining all the initiative and operating functions they now possess and having in addition a stronger part on the national committees in initiating national studies. Because of their more intimate contact with their constituents divisional committees will be able to exercise their initiative function more effectively than ever before. The national committees will initiate activities of a national character but will act more in a co-ordinating capacity, endeavoring to obtain any end which is desired nationally through co-operation of the corresponding divisional committees. In their dealings with each other corresponding divisional and national committees will act through the divisional representative on the national committee, who is either the chairman of the divisional committee or a man appointed by him. The divisional committees, through their relations with the national committees, will be better able to co-ordinate their interdivisional efforts. Although the national committees will co-ordinate and compile for national presentation the findings submitted by the divisional committees, the latter will not be prevented from presenting to their immediate constituents in published form the results of their individual work.

With the expansion of geographic activities the interest of small and medium-size companies will be aroused, and their problems, clearing through the divisional committees, will receive greater consideration nationally.

Presentation of committee findings in the form of serial reports published from time to time will continue to be an inseparable and increasingly important part of the new policy for several reasons. First of all, member companies want the information while it is fresh and do not want to wait twelve months for an annual report. Second, presentation of serial reports prevents the publishing peaks which formerly occurred at convention time, requiring excessive expenditure of time, labor and money, to say nothing of issuing a mass of literature at one time when it cannot be assimilated. Annual committee reports hereafter will be largely résumés of high points in the past year's activities and findings, followed by recommendations for the coming year's work.

Finally, continuity of policy, purpose and performance will be assured by eliminating practices which in the past have caused periods of inaction. The committees will continue to function so long as there is a need for their services. Changes in personnel will be made as occasion demands and not only at the beginning and end of a fiscal year.

Utilizing the mechanism described, the program of the National Technical Section will be accomplished this year with only two national group meetings, of which the first was that just held in St. Louis. As the plan further develops it is evident that divisional activity will increase and the demand upon the time of national committeemen for detail work will be proportionately reduced.

N. F. P. A. Electrical Committee Meets November 21

The electrical committee of the National Fire Protection Association will meet at 109 Leonard Street, New York City, on Friday, November 21. At the meeting plans will be discussed and determined upon concerning future procedure with respect to proposed amendments to the "National Electrical Code." It is not intended that any such amendments will be finally acted upon at the coming meeting. Among the important items of the agenda for the meeting are:

1. Organization of a section committee under the rules of procedure of the American Engineering Standards Committee.

2. Revision of the standing committee formation as previously established

and the assignment of topics according to the editorial form of the 1923 edition of the National Electrical Code.

3. Abolishing the new developments committee and reassignment to appropriate new standing committees of items now in the portfolio of the new developments committee.

4. Determination of approximate date of the next meeting of the electrical committee, when amendment of the National Electrical Code will be undertaken.

5. Discussion and possible determination of the question "Shall the electrical committee conduct public hearings as has been the custom heretofore?"

A. R. Small, vice-president of Underwriters' Laboratories, Inc., who was recently appointed chairman of the electrical committee, succeeding Dana Pierce, will preside at the meeting.

Briefer News

Long Sault Rapids Plant to Go Ahead.—Reports from northern Ontario are to the effect that the Abitibi Power & Paper Company is planning to proceed with the development at Long Sault Rapids, where a power plant costing more than $1,000,000 will probably be erected.

Byllesby Company Denies Negotiations for San Joaquin Property.—John J. O'Brien, president H. M. Byllesby & Company, in a statement to the ELECTRICAL WORLD, denies unequivocally that his company is negotiating for the purchase of the San Joaquin Light & Power Company of Fresno, Cal. His statement is in refutation of newspaper reports on the Pacific Coast that the Byllesby interests are striving for the control of the California company.

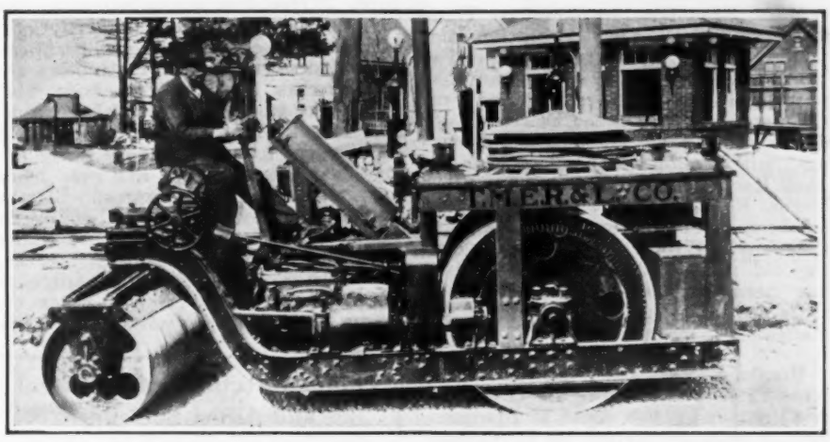
General Electric Company Establishes Scholarships in Memory of Steinmetz.—The General Electric Company has appropriated $25,000 to form a fund the income from which will be used to provide four scholarships at Union College, Schenectady, N. Y., as a memorial to the late Charles P. Steinmetz, the company's chief consulting engineer. Dr. Steinmetz was for many years a professor at Union College.

Program of December A. S. M. E. Meeting.—Among the subjects that the American Society of Mechanical Engineers will review at its New York meeting on December 1 to 4 are oil handling and storing, oil burning, refrigeration, lubrication, the hazards of pulverized-fuel systems, machine-shop problems, thermal efficiency, design of penstocks and draft tubes, and high pressures. There will be a public hearing on power test codes.

Big Hydro-Electric Plant Projected for Matagami River, Ontario.—A proposal to build a great paper plant at Kapuskasing, in northern Ontario, will, if carried out, involve the expenditure of $5,000,000 to develop water power, estimated at 200,000 hp., on the Matagami River at Smoky Falls, where three streams unite and fall over a 76-ft. cliff. These falls are 28 miles from the railroad, which it is proposed to extend to the property.

Puget Sound Company and Long-Bell Lumber Company "Tie In."—The Puget Sound Power & Light Company of Seattle and the Long-Bell Lumber Company, whose plant on the Columbia River, 50 miles northwest of Portland, Ore., was illustrated in the ELECTRICAL WORLD for October 18, page 857, have completed an interconnection near the company's mill which will be used in case of an emergency such as a break in the transmission lines of either company. Three large transformers have been installed, and it is announced that both Longview, the new city that has been built by the lumber company, and Kelso, Wash., which is on the lines of the Puget Sound company, can now be sure of uninterrupted supply.

Electrifying the Steam Roller. — A motorman, instead of an engineer and fireman, operates the newest type of road roller, owned by the Milwaukee Electric Railway & Light Company. Electricity was decided upon when it was found that one of the company's steam rollers needed extensive repairs.



A General Electric railway-type motor and a type K controller with resistors from stock, together with a mining locomotive cable reel, were used in remodeling the machine. The motor was so mounted that it drives the pinion previously driven by the steam engine. The electric roller is operating very successfully on streets where a trolley circuit is available to furnish power.

Extensive Transmission Lines to Be Built in Central Illinois.—W. A. Baer, general manager of the Illinois Power & Light Corporation, is quoted as saying that that company will spend $3,000,000 to $5,000,000 in the development of power lines in and around Decatur, Ill., within the next three years. A substation will be erected in Decatur which will cost more than $1,000,000 and will be the center of power lines that will connect Peoria, Bloomington, Springfield and Decatur. From Decatur a line will be run to Champaign and Danville, and it is planned to connect Peoria with Keokuk.

Another North Carolina Hydro-Electric Plant.—It is announced that the town of Franklin, N. C., the county seat of Macon County, has begun the erection of a dam 2 miles north of the town in the Tennessee River and that $300,000 will be spent on a water-power development there. Part of the power to be generated has already been sold to industrial firms and part will be used for municipal and public purposes, it being hoped that a tourist resort will spring up on the 150-acre lake that will be formed.

Clarke County, Wash., Grants Northwestern Electric Company Fifty-Year Franchise. — The board of commissioners of Clarke County at Vancouver, Wash., has granted the Northwestern Electric Company, Portland, Ore., a fifty-year franchise on thirty-seven roads in the county on which the company did not previously hold a franchise. This gives the company the right to erect power lines on virtually every road in the county, but the franchise will lapse on all roads not used for this purpose within five years.

Fulton County (N. Y.) Company Gets Middleburgh & Schoharie Plant.—The New York Public Service Commission has authorized the purchase by the Fulton County Gas & Electric Company of Gloversville of the Middleburgh & Schoharie Electric Light, Heat & Power Company, as well as the electric light plant of Lewis R. Brown of Worcester, Otsego County. This is another of the numerous absorptions of small plants by larger systems which are going on all over New York State.

Great Northern Railroad Plans Electrification.—From a representative of the Great Northern Railroad comes the announcement that that road will soon start on the electrification of an 80-mile section of its line over the summit of the Cascade Mountains. The line between Wenatchee, Wash., and Skykomish will be the first to be electrified, according to this statement, and power will be furnished by a power plant to be built by the company on the Chelan River. The site has already been purchased and plans have been made to construct a generating station capable of supplying the entire electrified line. Plans prepared before the war for the electrification of the line between Spokane and Seattle, which were post-

poned because of the high prices for materials, are, it is asserted, to be taken up and pushed to completion.

Delaware River Treaty Commission Begins Work.—Preliminary conferences on the proposed Delaware River treaty have been held by the Delaware River Treaty Commission with representatives of the state commissions of New York, New Jersey and Pennsylvania and of the federal government, and the provisions of the treaty are beginning to take definite form. The next meeting of the treaty commission will be held at Atlantic City about the middle of November. (See ELECTRICAL WORLD for September 27, page 701.)

Convention of Western Association of Electrical Inspectors.—The Western Association of Electrical Inspectors will hold its annual convention at the Brown Hotel, Louisville, Ky., on January 27, 28 and 29, 1925. Every one interested in specifications and regulations covering the installation of electrical equipment is invited to attend. Programs and other detailed information may be obtained from the chairman of the arrangements committee, G. M. Miller, Louisville Gas & Electric Company, 1304 South Seventh Street, Louisville.

More Transfers in Iowa. — Three more sales of small central-station companies are reported from Iowa. The Northeastern Iowa Power Company has purchased the Dunkerton Light & Power Company and the Greene Electric Light & Power Company. The purchasing company will develop water power from the Shell Rock River at Greene. The Hopkinton Electric Light & Power Plant has been sold to the Iowa Electric Light Company. Within the last two years the old mill which housed this plant has been replaced by an up-to-date structure and modern machinery installed.

Brenham, Tex., May Be Center of New Transmission System.—The electric light and power plant at Brenham, Tex., heretofore owned by D. C. Giddings and his associates in the Brenham Compress Oil & Manufacturing Company, has been sold to the Texas Public Utilities Company, a subsidiary of the Texas Power & Light Company of Dallas, and it is announced that an extensive system of power transmission lines is to be built by the company in that part of the state which will cover the 185 miles between Houston and Austin, with Brenham as the probable site for the main power station. The expenditure that this program will ultimately involve is put at approximately ten million dollars.

Standardizing Manholes.—A preliminary conference of representatives of utility companies, municipalities and others interested in the standardization of manholes was held last week with the Division of Simplified Practice of the Department of Commerce. The National Electric Light Association was represented by Alexander Maxwell. So many engineering problems were presented as essential to consideration in any program of standardization that it was decided first to refer the matter to the American Engineering Standards Committee with a request that a study be made of the technical questions involved and that a report be made on the best practice. It is felt that after this shall have been done the question of simplifying sizes and designs in accordance with the best engineering practice will be easy.

Chicago's Radio Exhibition. — The third annual Chicago Radio Show will open in the Coliseum on November 18 and continue until November 23. It gives promise of equaling the success of the recent radio fair in New York City. One hundred and eighty of America's radio manufacturers and twenty of the wireless concerns of England, France, Italy, Germany and Japan will be among the exhibitors, and more than five million dollars' worth of apparatus, covering every phase of the industry, will be on display.

Emmet Mercury-Vapor Process.—The following joint statement has been issued by the Hartford (Conn.) Electric Light Company and the General Electric Company regarding the Emmet mercury-vapor process, the first commercial installation of which has been in operation for over a year at Hartford. "The Emmet mercury turbine and boiler installation made for the Hartford Electric Light Company has attracted a great deal of attention and the success achieved has been very gratifying to all concerned. Experience indicates that certain improvements in details can to advantage be made and the necessary changes are now being carried out. The Hartford Electric Light Company has received many requests for information and permission to inspect the equipment and it has extended every courtesy possible to visitors, but while these changes are being made it is not possible to admit visitors to the station and in order to avoid disappointments this notice is issued. When this equipment is again operating announcement will be made in the press and facilities provided for inspection."

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

Associated Manufacturers of Electrical Supplies — Association office and Hotel Roosevelt, New York, Nov. 10-14. F. Nicholas, 30 East 42d St.

National Association of Railway and Utilities Commissioners — Phoenix, Ariz., Nov. 11-14. James B. Walker, New York Transit Commission, New York.

West Virginia Public Utilities Association — Charleston, W. Va., Nov. 14-15. Bliss McCrum, secretary.

National Electrical Credit Association (Middle and Atlantic States)—Philadelphia, Nov. 14. F. P. Rose, Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association —Hotel Cleveland, Cleveland, Nov. 19-21. Franklin Overbagh, 411 South Clinton Street, Chicago.

American Society of Mechanical Engineers—New York, Dec. 1-4. C. W. Rice, 29 West 39th St., New York.

Western Association of Electrical Inspectors — Brown Hotel, Louisville, Ky., Jan. 27-29. G. M. Miller, 1304 South Seventh St., Louisville.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 28-30. H. M. Northrup, 23 Erie St., Milwaukee.

Growth of Electric Service in Dallas.—In order to meet growing demands, the Dallas Power & Light Company has recently made important enlargements of its plant. Charles W. Davis, vice-president and general manager of the company, says that the additions completed during the present calendar year cost approximately $2,325,000. The present generating capacity is approximately double what it was prior to August 12 last. A new substation has been built in North Dallas to care for new business. This substation represents an investment of approximately $200,000. It supplies service for residence lighting, industrial motors and street railway service. During the twelve months just passed the company delivered to consumers 103,534,364 kw.-hr., as compared with 88,301,194 kw.-hr. for the previous year, and the company is serving 45,966 consumers, as compared with 41,780 a year ago.

Tennessee Electragists Meet. — The Tennessee Association of Electragists held its thirteenth annual meeting at the Hotel Hermitage, Nashville, October 27. Eighty delegates were present. President D. L. Nicholson, Nashville, presided. C. L. Jacquet of New York spoke on "Electrical Development," J. T. Shannon of Nashville on "How the Contractor-Dealer Can Establish Himself Successfully in the Field of Merchandising," J. J. Brennan of Memphis on "Central-Station Merchandising," R. L. Clift of Memphis on "Radio Merchandising," Charles Wright of Knoxville on "Estimating," and W. R. Herstein of Memphis on "The Relation of the Jobber to the Contractor." The following officers were elected: President, Emmett Scott, Chattanooga; first vice-president, J. G. Cason, Knoxville; second vice-president, R. L. Clift, Memphis; third vice-president, John Mullen, Nashville; secretary-treasurer, J. A. Fowler, Memphis.

Washington-Idaho Company to Be Sold at Auction. — The United States Court for the Eastern District of the State of Washington has ordered the properties of the Washington-Idaho Water, Light & Power Company to be sold on November 10 from the front door of the court house in Lewiston, Idaho, to the highest and best bidder. The properties of the company in western Washington will be sold at Chehalis, Wash. This sale will mark the close of a long litigation and the liquidation is expected to put the utilities on a stable basis, it being thought that they will be bid in by one of the large central-station companies operating in the Pacific Northwest. The Washington-Idaho Company, with headquarters at Clarkston, Wash., serves a population of 15,000 in Clarkston, Lewiston and other places in the two states. Its outstanding capital was reported last year as $525,000 and bond issues as $734,000.

Men of the Industry

R. A. Weagant Joins De Forest Radio Company

Roy A. Weagant, for many years prominently identified with the advancement of radio engineering and until recently chief consulting engineer of the Radio Corporation of America, has been elected vice-president and chief engineer of the De Forest Radio Company. Mr. Weagant was educated at McGill University, Montreal, and first

R. A. WEAGANT

became interested in wireless as a student of Sir Ernest Brotherford. After a short association with the Montreal Light, Heat & Power Company, the Westinghouse Electric & Manufacturing Company and the De Laval Steam Turbine Company, he took up commercial wireless work in 1908, when he entered the employ of the National Electric Signaling Company. Subsequently he affiliated himself with the Marconi Wireless Telegraph Company of America, soon advancing to the position of chief engineer. When the Marconi company was absorbed by the Radio Corporation of America he was retained as consulting engineer. It was while occupying this post in 1920 that the Leibmann memorial prize was awarded to Mr. Weagant for his contributions to the progress of radio development. He is a charter member and a fellow of the Institute of Radio Engineers and a member of the New York Electrical Society.

Percy Wheeler, formerly distribution engineer for the Jackson district of the Consumers Power Company, has been appointed local manager for the company at Mason.

E. N. D'Oyly, who has been superintendent of distribution of the Western States Gas & Electric Company, Stockton, Cal., has been appointed general superintendent of the electric department of that company. After being graduated from the University of New Zealand in 1910, he entered the employ of the Western Canada Power Company, where he was engaged in hydro-electric construction work. In 1913 he joined the Stone & Webster forces in the construction of the Big Creek No. 1 plant of the Southern California Edison Company. After war service Mr. D'Oyly returned to California and became identified with the Western States Gas & Electric Company. In his present position he will have charge of electric generation and distribution for the Stockton division of the company.

D. L. Huntington, president of the Washington Water Power Company, Spokane, was made the guest of honor at the semi-monthly company dinner held at the Spokane Club on October 18, that day being the thirtieth anniversary of his connection with the company and also his birthday. In behalf of the staff he was presented with an open-faced gold watch suitably inscribed.

R. H. Timmons Re-elected Head of Kansas Association

Robert H. Timmons, assistant to the vice-president and director of sales of junior securities of the Kansas Gas & Electric Company, Wichita, has been re-elected president of the Kansas Public Service Association. In his company activities he is responsible for all phases of public relations involving employees, customers and the general public. He is also director of all the company's advertising. Mr. Timmons joined the Kansas Gas & Electric Company about six years ago, bringing with him experience in activities outside the utility field that particularly fits him for the post he occupies. For example, he had administrative and financial experience as vice-president and superintendent of a large Middle West casualty company which, with other similar companies, he helped to organize. For about ten years prior to that he was a securities salesman. For five years he was part owner and publisher of a newspaper, entering this field immediately after graduation from Emory University, Atlanta, Ga., as a reporter and later becoming assistant manager of the Associated Press at Atlanta. Mr. Timmons is a member of the Public Relations Section, Middle West Division, N. E. L. A., and a state director for Kansas of the better-home-lighting activity. He is senior aide on the staff

R. H. TIMMONS

of Governor J. M. Davis of Kansas, a member of the Topeka and Wichita press clubs, active in the Wichita Chamber of Commerce and other commercial organizations and a member of several social clubs.

Obituary

Leon C. Spaulding, president of the Spaulding Fibre Company, Inc., Tonawanda, N. Y., died September 11.

Charles Willard Young, vice-president, secretary and general counsel of the American Light & Traction Company and a member of the banking firm of Emerson McMillin & Company, New York, died October 29 in his forty-seventh year. Mr. Young was a native of Yaphank, Long Island, N. Y., and was admitted to the bar in 1898. He was also a director of the American Light & Traction Company and of the Southern Light & Traction Company and an officer and director in several industrial enterprises.

Dr. Bruno V. Nordberg, founder and president of the Nordberg Manufacturing Company, Milwaukee, died at his home in that city October 30. For more than forty years he had been an important factor in engineering progress and development in the power and mining machinery fields, and his death is a serious loss to these branches of the engineering profession. As a steam engineer he stood pre-eminent among his contemporaries. A Finn by birth and a graduate of the University of Helsingfors, he came to America in 1880 and soon after his arrival entered the employ of the E. P. Allis Company, where he engaged in design work, adopting the poppet valve which has since become an absolute necessity for the utilization of the high steam pressures and superheats of modern steam practice. In 1886 the Bruno V. Nordberg Company was organized to engage in the manufacture of governors. Under Dr. Nordberg's direction this company from a humble beginning developed the present nationally known Nordberg Manufacturing Company, whose staff of engineering experts are equipped with a valuable fund of technical knowledge imparted to them by him after years of study and research. Among the achievements which brought Dr. Nordberg recognition in both America and Europe are included the designs for large hoists and compressors for metal-mine service for which he was largely responsible and also hoists for air and electric operation. He was a member of many engineering and scientific societies, and last year the degree of doctor of engineering was awarded to him by the University of Michigan.

Financial and Corporate

Utility Market Livens

Trading Spurts on the Eve of Election, Values Moving Forward in Many Sections

DURING the pre-election week that ended Saturday, November 1, the market in power and light stocks followed much the same course as that in other issues. Trading at first was dull and uneventful, but as election day approached a considerable activity developed. The previous waiting attitude changed to a buying moment. The gains for the week were not large, except in the case of Cities Service Company's shares, but the more important issues made improvement.

The thing that sent the Cities Service stock up was the news that the Doherty interests had segregated the power and gas properties from the oil properties. On Friday, when the general market heard the plan, the common stock rose 5 points. In Saturday's short session the stock jumped another 18½ points in an active market for that issue. During the week Cities Service increased in value from 142 to 177, taking the best point on Saturday, a net gain of 35 points. American Power & Light Company's new stock also set a new top at 48¼, adding something more than four points to its level of the week before. Such a gain is far more significant, of course, now that the stock is divided than a similar gain would have been before. This comes from the fact that American Power & Light now is much more heavily traded in than before.

Another favorite for the week in the unlisted market was American Gas & Electric Company's shares. The quotation for these rose five points, and trading became lively toward the close of the period. Greater activity and higher prices in Alabama Traction, Light & Power Company's stock were the result of good reports of developments for the new holding company, the Southeastern Power & Light Company.

New Capital Issues

The flotation last week of a twenty-five-million-dollar issue of general mortgage 5's of 1949 by the Brooklyn Edison Company had an interesting bearing on the present money situation. Only part of the funds will be used for development work. The remainder will be used to redeem the two 7 per cent series of bonds outstanding under the same mortgage. Substitution of 5's for 7's will, of course, save the Brooklyn Edison Company a substantial amount in annual interest charges. While the company was obliged to sell 7 per cent coupon bonds four years ago, it found no difficulty in selling 5's last week. The difference primarily was one in the price of money since the credit of the company stood high when the 7 per cent series was offered. With the price of money now very low and the general popularity for bonds of that description, the issue was quickly oversubscribed. That is significant since the bonds were retailed at par, or on a 5 per cent yield basis.

The Southeastern Power & Light Company, the new holding company in control of the Alabama Power Company, was responsible for an offering of $7,500,000 of secured 6 per cent notes due in 1929. It is understood that earnings for the new company are favorable but that the company desires new money to purchase certain other utility properties in the Southeast which will increase its net revenues substantially. In connection with the flotation of the notes it was reported that gross earnings for Southeastern and its subsidiaries during the twelve months ended August 31, 1924, were $9,541,246 and net $2,454,372, as compared with annual interest requirements of only $1,133,445. The notes were sold at par.

The Standard Power & Light Corporation's offering of 100,000 shares of 7 per cent cumulative preferred stock at $100 per share, involving $10,000,000, also was made in part to extend the corporation's control.

Detroit Edison Company's Growth

A New Mortgage Designed on Modern Lines Has Just Been Created by a Far-Sighted Management

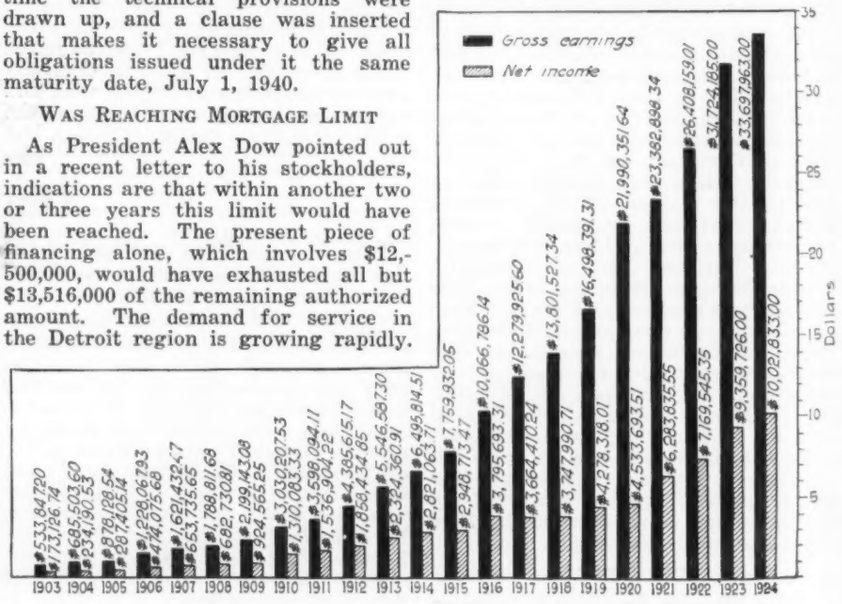
BY PAUL WILLARD GARRETT

THE management of the Detroit Edison Company recently has revealed foresight in a modification that it has adopted of the company's vehicle for bond financing. The company's instrument for bond financing heretofore has been its first and refunding mortgage. That mortgage is a good one from the standpoint of quality, of course, being a general lien on the various properties. But the authorized limit was fixed at $75,000,000 at the time the technical provisions were drawn up, and a clause was inserted that makes it necessary to give all obligations issued under it the same maturity date, July 1, 1940.

WAS REACHING MORTGAGE LIMIT

As President Alex Dow pointed out in a recent letter to his stockholders, indications are that within another two or three years this limit would have been reached. The present piece of financing alone, which involves $12,500,000, would have exhausted all but $13,516,000 of the remaining authorized amount. The demand for service in the Detroit region is growing rapidly. Since the present company was organized twenty-one years ago, in 1903, the population served by the company has increased from 426,100 to 1,600,000. The annual kilowatt-hour output has grown from 14,640,000 to 1,443,936,200. Gross earnings have swelled from $685,504 a year to $33,697,963. There is every reason to expect a continued growth in the business. To have let another two or three years pass before attacking the problem would only have complicated matters. The present almost unprecedented ease in money conditions was another reason for acting now.

The solution worked out by the Detroit Edison Company and its bankers takes the form of a new mortgage, executed as of October 1, 1924, known as the general and refunding mortgage. No more first and refunding mortgage bonds will be issued except such as are issued to be pledged under general and refunding mortgage bonds. The new general and refunding mortgage is strictly a modern instrument. It is what is called an open-end lien; that is, no specific authorized amount of bonds is fixed as a limit. Subject to certain restrictions, general and refunding mortgage bonds can be issued up to



DURING ITS TWENTY-YEAR HISTORY THE DETROIT EDISON COMPANY HAS NEVER REPORTED A DECREASE IN YEARLY EARNINGS

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par value of stocks is $100.)

Companies	Bid Price Saturday, Nov. 1	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	a 97	94	97¼
Appalachian Power, 7 per cent	a 89	85½	90
Arkansas Light & Power 7 per cent	a 91½	81	93
Asheville Power & Light 7 per cent	96	96	99
Central Illinois Public Service 6 per cent	84	84	87
Colorado Power 7 per cent	a 92	90	98
Connecticut Light & Power 7 per cent	a104	99	106
Consumers' Power 6 per cent	a 91	85	93
Dayton Power & Light 6 per cent	84	84	90
Duquesne Light 7 per cent	106	103½	107½
Eastern Texas Electric 6 per cent	a100	81	100
Empire District Electric 6 per cent	73	70	78
Fort Worth Power & Light 7 per cent	99	97	102
Great Western Power 7 per cent	98	96	99
Illinois Northern Utilities* 6 per cent	a 85½	82	87
Illinois Power & Light 7 per cent	a 92	84	95
Kansas Gas & Electric 7 per cent	94	92	97
Long Island Lighting 7 per cent	99	95	99
Minnesota Power & Light 6 per cent	89	78	89
Mississippi River Power 6 per cent	a 88	80	90
Nebraska Power 7 per cent	97	89	99
Niagara Falls Power 7 per cent—25	a 28½	27	29
Niagara, Lockport & Ont. Power 7 per cent	101½	99½	104½
Northern States Power 7 per cent	a 95	91	97
Ohio Public Service 7 per cent	94	86	100
Pacific Gas & Electric 6 per cent	90	85½	92½
Penn-Ohio Power & Light 7 per cent	90	84	96½
Pennsylvania Power & Light $7—no par	98¾	93	99
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	a 37½	29¼	39¾
Southern California Edison 8 per cent	a115	112	120
Tennessee Electric Power, 6 per cent	a 78½	71	81
Texas Power & Light 7 per cent	97	95	97½
Utah Power & Light 7 per cent	95½	94	96½
Western States Gas & Electric 7 per cent	80	78	85
Yadkin River Power, 7 per cent	97	94	97½
Holding Companies			
American Gas & Electric 6 per cent—50	a 44	41½	46
American Light & Traction	a 92	91	9-½
American Power & Light 6 per cent	a 87	84	91
American Public Service 7 per cent	88	84	92
American Public Utilities 7 per cent	a 88	73	90
American Water Works & Electric 6 per cent	a 95	66	99
Associated Gas & Electric	a 48	48	50
Carolina Power & Light	100	82½	100
Central Indiana Power 7 per cent	88	80	92
Cities Service 6 per cent	a 81⅞	67	81⅞
Commonwealth Power	a 79	72	82
Consolidated Gas 6 per cent—50	a 57	51	59½
Continental Gas & Electric 7 per cent	a 90	69	93
Electric Bond & Share 6 per cent	a103	96½	103
General Gas & Electric—$8—no par	a102	96	103½
Middle West Utilities* 7 per cent	a 91	80	91
National Power & Light—$7—no par	a 94	84	96½
North American 6 per cent—50	a 48½	43¾	50¼
Northern Ohio Electric	a 24	16	34
Public Service Corp. of N. J. 7 per cent	99½	96½	100½
Public Service Corp. of N. J. 8 per cent	107⅜	99½	110
Standard Gas & Electric 8 per cent—50	a 49	46½	49½
‡United Gas Improvement—50	a 57½	55½	58
United Light & Power—$6.50—no par	83	75¼	84
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	a 32	22½	34
Appalachian Power—no par	a 69	66	93
Arkansas Light & Power	a 60	22	63
Brooklyn Edison	a119½	107½	120
Buffalo General Electric	151	118	155
Colorado Power	a 33	21	35
Commonwealth Edison*	a132¼	126	135
§Consolidated Gas, Electric Light & Power	a 34	33½	34
Dayton Power & Light	153	70	160
Detroit Edison	a109	102½	110½
|| Edison Electric Illuminating of Boston	a182	163½	190
*Kentucky Hydro-Electric	87½	84	87½
Long Island Lighting	160	100	195
Mississippi River Power	a 33	18½	34
Montana Power	65½	61¼	71
Niagara Falls Power—no par	42	42	48
Niagara, Lockport & Ontario Power—no par	51	45	59
Northern Ohio Electric—no par	a 9	5	16
Northern States Power	a101	92	106
North Texas Electric	a 60	58	84
Pacific Gas & Electric	a 97	90½	99¾
†Penn Central Light & Power—no par	60	57	60
§Pennsylvania Water & Power	a127	98¾	127
‡Philadelphia Electric—25	a 37½	29	39¾
Public Service Co. of Northern Illinois	a102	97	104
Puget Sound Power & Light	a 50	43½	61½
Southern California Edison	a 98	95	106
Tampa Electric	a167	134	167
Tennessee Electric Power—no par	a 39½	20	43
Virginia Power	55	16	70
Virginia Railway & Power	a 67½	36	72¾
West Penn. Co.	a 83	47½	98
Holding Companies			
‡American Electric Power—50	62	22½	62¾
American Gas & Electric—no par	a 87½	43½	97
American Light & Traction	a138	115	148
American Power & Light	a 47½	34½	48½
American Public Utilities	a 85	35	97
American Water Works & Electric	a110	40	126½
Carolina Power & Light—no par	230	103	240
Cities Service	154	140	156
Columbia Gas & Electric—no par	a 43⅞	33	44½
Commonwealth Power Corp.—no par	a100½	56	109
Consolidated Gas—no par	a 72¾	60¾	75½
Continental Gas & Electric	a 82	49	96
Federal Light and Traction	a 86½	75	91
General Gas & Electric	a 55	22	63
Lehigh Power Securities—no par	a 82½	31	89
Middle West Utilities*—no par	a 78	41	86
National Power & Light—no par	a162	60	190
Philadelphia Co.—50	a 48	42¾	53½
Power Securities—no par	a 8	4	14
Public Service Corp. of N. J.—no par	a 61½	39	63
Standard Gas & Electric—no par	a 38	31½	40½
United Gas & Electric (Conn.)—no par	27	14	42
Utah Securities	a 32½	16¾	37
BONDS			
Operating Companies			
Adirondack Power & Light 6s 1950	a102	97½	103
Alabama Power 5s 1945	95½	90½	96½
Appalachian Power 5s 1941	a 95	89	95½
Brooklyn Edison 5s 1949	a100½	97½	102½
6s 1930	a104½	102½	106¾
7s 1949	107¾	107	110½
Cleveland Electric Illuminating 5s 1939	100½	98½	101
Commonwealth Edison 5s 1943	99½	95	100
5s 1953	98½	92	99½
§Consol. Gas, Elec. Lt. & Pwr. 4½s 1935	a 93½	91½	95
6s 1949	105	102¾	105
Consumers' Power 5s 1936	98¾	94¼	99½
5s 1952	a 91	87	92¾
Detroit Edison 5s 1933	100⅝	99	101½
Duquesne Light 6s 1949	a105¾	103½	106½
Great Western Power 5s 1946	95	90½	96
Kansas City Power & Light 5s 1952	a 95	89	95⅝
Mississippi River Power 5s 1951	a 97	92	97
Montana Power 5s 1943	a 99	95	99
New England Power 5s 1951	99	97	100
New York Edison 6½s 1941	a113¾	109⅞	113¾
Niagara Falls Power 6s 1950	105½	104	105¾
Northern States Power 5s 1941	a 93½	89¼	94½
6s 1941	a104½	101	104½
Ohio Power 7s 1951	106	103	106¼
Pacific Gas & Electric 5s 1942	a 94½	90¾	95
Pennsylvania Water & Power 5s 1940	99	96	99½
‡Philadelphia Electric 5s 1966	a101¼	97	103¼
5½s 1947	105	99½	105
6s 1941	a107	103¾	107½
Portland Electric Power 6s 1947	a 95	89½	97
Southern California Edison 5s 1939	99¼	96	100
6s 1944	102¼	100	103½
Tennessee Electric Power 6s 1947	a 98	93¾	98¾
Texas Power & Light 5s 1937	96½	91½	96½
Toledo Edison 7s 1941	a110	106	110
Utah Power & Light 5s 1944	a 92½	87½	93½
Holding Companies			
Alabama Traction, Light & Power 5s 1962	82½	65½	83
American Gas & Electric 6s 2014	a 95	94	95¾
American Power & Light 6s 2016	a 94	91	94½
Amer. Water Works & Electric 5s 1934	a 92¾	84½	94
Associated Gas & Electric 6½s 1954	a 97¼	92½	94½
Central Indiana Power 6s 1947	94½	88	95
Commonwealth Power 6s 1947	a 97½	87	98
Consolidated Cities Lt., Pwr. & Tr. 5s 1962	75½	64	76½
Illinois Power & Light 6s 1953	99½	95	100½
United Light & Railways 5s 1932	94	87¼	94
6s 1952	96	92	97½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	a100	90	100¾
*National Carbon	118½	112	125
Worthington Pump & Machinery	a 82	68	85
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 60¾	41¾	66½
American Bosch Magneto—no par	a 26½	22½	38¾
Electric Storage Battery—no par	a 59½	50½	64
General Electric	a257½	193½	281
General Electric—10	a 11½	10½	11½
*Hurley Machine—no par	a 61	48	65¾
†Wagner Electric	20½	20	34½
Westinghouse Electric & Manufacturing—50	a 63½	55½	65
Worthington Pump & Machinery	a 42¾	23¼	47½
BONDS			
Canada General Electric 6s 1942	a107	102½	107
General Electric 3½s 1942	83	80	83¾
5s 1952	a104¾	100	105½
Robbins & Myers 7s 1952	70	70	91½
†Wagner Electric Manufacturing 7s	100½	97	101
Western Electric 5s 1944	a 99½	96	99½
Westinghouse Electric & Mfg. 7s 1931	a108½	106½	109½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. §Baltimore Stock Exchange.
a Bid price Monday, November 3.

any amount. The same mortgage now may be used in bond financing for an indefinite period in the future.

Restrictions in the indenture protect present bondholders against the issuance of general and refunding mortgage bonds in excessive amounts. General and refunding bonds may be issued (1) against the deposit of $13,516,000 first and refunding mortgage bonds to be held in the Treasury, (2) to retire $48,984,000 additional underlying bonds held by the public or outstanding prior-lien bonds, and (3) for future financing so long as the conditions are complied with. Among these are the provisions that the amount of such new bonds must not exceed 75 per cent of the actual cost or value of property additions and that earnings as defined must equal one and three-quarters times annual interest requirements on all bonds to be outstanding.

STRUCTURE IS GREATLY IMPROVED

One other interesting feature is the fact that bonds may be issued with varying maturity dates, a thing that was not true under the first and refunding mortgage. Bearing these more important changes in mind, material advantages will be seen to have resulted from the change in financial structure. The company has maintained a conservative ratio as betweer its contributed and borrowed capital and is in good position to finance advantageously through the sale of either capital stock or bonds.

From its gross earnings of $33,697,963 for the twelve months ended September 30, 1924, the amount earned as net was $10,021,833. With annual interest requirements on all bonds presently to be outstanding aggregating only $3,257,390, net earnings were sufficient to cover such fixed charges more than three times. So material have been the surplus amounts after payment of the fixed charges that for more than a decade the company has been able to pay susbtantial dividends to holders of the capital stock. Indeed, for many years the company has been unusually successful in financing, largely through the sale of convertible debentures and capital stock, a thing that testifies in splendid fashion to the soundness of the senior obligations.

Montana Power Quarterly Report.—The Montana Power Company, including subsidiaries, for the quarter ended September 30 reports surplus of $687,322 after taxes and charges, compared with $712,267 in the third quarter of 1923. For nine months ended September 30 the surplus after taxes and charges amounted to $2,273,005, against $2,513,187 for the corresponding period of the previous year.

Milwaukee Utility Pays Hundredth Consecutive Dividend—The Milwaukee Electric Railway & Light Company, a subsidiary of the North American Company, paid the one hundredth consecutive quarterly dividend November 1 on its 6 per cent preferred stock to about nine hundred stockholders. The company has also paid dividends regularly on its later preferred issues sold in 1921 and since. Cash dividends averaging 8 per cent have been paid on common stock for twenty-two years.

Cities Service's New Plan

Is Organizing Hundred-Million-Dollar Operating Company Divorced from Oil Business

WITH the purpose of separating its public utility enterprises from its oil business and of providing the means of a more intensive development and expansion of its electrical properties throughout the country, the Cities Service Company has undertaken the formation of a hundred-million-dollar concern to be known as the Cities Service Power & Light Company. The new organization will be the operating company while the Cities Service Company will be the holding company, taking over all the common shares, amounting to $65,000,000, into which will be merged the common stock of the Henry L. Doherty properties operating in fifteen states and serving a population of more than two million. The remainder of the authorized capitalization will consist of $20,000,000 in bonds, $10,000,000 in preferred stock and $5,000,000 in second preferred stock.

Among the more important properties that will be operated by the new company are the Toledo Edison Company, the Ohio Public Service Company, the Public Service Company of Colorado, and the Empire District Electric Company, and the smaller companies include the St. Joseph (Mo.) Railway, Light, Heat & Power Company, the Athens (Ga.) Railway & Electric Company, the Bartlesville (Okla.) Gas & Electric Company, the Bristol (Va.-Tenn.) Gas & Electric Company, the Brush Electric Company of Galveston, Tex.; the City Light & Traction Company of Sedalia, Mo.; the City Light & Water Company of Amarillo, Tex.; the Danbury & Bethel (Conn.) Gas & Electric Light Company, the Durham (N. C.) Public Service Company, the Ozark Power & Water Company of Missouri, the Meridian (Miss.) Light & Railway Company, and the Capital Gas & Electric Company of Topeka, Kan.

Officers of the new company will include the principal executives of the Cities Service organization.

Capitalization of New Byllesby Holding Company

The capitalization of the Standard Power & Light Corporation, an announcement concerning the formation of which appeared in last week's issue of the ELECTRICAL WORLD, will consist of 100,000 shares of preferred stock and 400,000 shares of common stock, both stocks being without nominal or par value. The preferred shares will, however, be entitled to $100 a share and accrued dividend in case of liquidation before any distribution on the common. The preferred shares will be cumulative and will pay dividends at the rate of $7 per share annually. As stated elsewhere in this issue, H. M. Byllesby & Company made public offering of 100,000 shares of the cumulative preferred stock. The price was $100 a share and with each share of preferred was given one share of common stock. In addition to the proceeds from the sale of 100,000 shares of cumulative preferred stock and 100,000 shares of common stock the company will receive $2,000,000 from the Standard Gas & Electric Company and H. M. Byllesby & Company for the remaining 300,000 shares of common stock.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the past week:

Name of Company	Per Cent	When Payable
Central Arizona Lt. & Pr., com.	$1	Nov. 1
Central Arizona Lt. & Pr., pf.	2	Nov. 30
Charleston Gas & Electric	$2.50	Nov. 1
Consolidated Gas	$1.25	Dec. 15
Milwaukee Elec. Ry. & Lt., 6% pf.	1½	Nov. 1
Pacific Lighting, com.	4	Nov. 15
Pacific Lighting, pf.	1¾	Nov. 15
Philadelphia Subur. Gas & El., pf.	$1.75	Nov. 1
Portland Electric Power, 2d pf.	1½	Dec. 1
White (J. G.) & Company, pf.	1¾	Dec. 1
White (J. G.) Engineering, pf.	1¾	Dec. 1
White (J. G.) Manag'm't Corp., pf.	1¾	Dec. 1

Company Reports

Among the company reports issued during the past week for the month of September are the following:

Name of Company	Gross Revenues for September 1924	1923
American Water Works & Elec. and subsidiaries	$3,063,216	$3,101,149
Asheville Power & Light	94,300	88,675
Baton Rouge Electric	57,654	50,425
Binghamton Lt., Heat & Pwr.	113,355	99,752
Blackstone Valley Gas & Elec.	368,669	361,223
Cape Breton Electric	49,491	61,965
Carolina Power & Light	229,669	202,390
Cent. Mississ. Val. elec. prop.	47,273	47,254
Columbus Electric & Power	196,511	183,576
Edison El. Illum. of Brockton	119,445	122,505
Electric Light & Power Co. of Abington and Rockland	39,333	40,429
El Paso Electric	206,577	197,845
Fort Worth Power & Light	255,555	263,260
General Gas & Elec. and sub.	1,603,630	1,306,741
Houghton County Elec. Light	38,367	41,366
Kansas Gas & Electric	429,508	402,937
Keokuk Electric	34,378	34,780
Key West Electric	19,899	19,581
Los Angeles Gas & Electric	638,296	487,561
Lowell Electric Light	119,962	115,995
Metropolitan Edison and sub.	646,974	642,826
Mississippi River Power	275,560	252,704
Nebraska Power	311,216	311,014
New Jersey Power & Light	85,451	84,017
Northern Texas Electric	212,841	232,116
Pacific Power & Light	273,413	288,106
Paducah Electric	49,270	49,021
Pennsylvania Edison & sub.	241,280	279,291
Puget Sound Power & Light	985,009	987,166
Reading Tran. & Lt. and sub.	233,787	252,012
Rutland Ry., Light & Power	48,491	49,102
Savannah Electric & Power	152,075	160,810
Sayre Electric	18,462	16,479
Sierra Pacific Electric	89,736	86,042
Southern Canada Pr. and sub.	101,936	81,275
Tampa Electric	168,533	167,205
Texas Power & Light	558,769	519,337
Vermont Hydro Electric	61,030	68,552
West Penn	1,950,928	2,010,002
Yadkin River Power	183,491	154,615

Bonds Called in November.—A large number of light and power companies are taking advantage of the present low interest rates by calling in advance of maturity bonds bearing high coupon rates. Among the issues called for redemption during November are the following: Puget Sound Power & Light 7½'s, due in 1941, amounting to $13,476,500; Columbia Gas & Electric 5's, due in 1925, amounting to $11,500,000; Interstate Power 8's, due in 1926, amounting to $400,000; Utilities Power & Light 7's, due in 1928, amounting to $300,000, and the Crookston Water, Power & Light 7½'s, due in 1936, amounting to $200,000. In the list of issues called for payment in part were the Connecticut Light & Power 7's of 1951, amounting to $78,500, and the Mississippi River Power 7's of 1935, amounting to $61,800.

Commission Rulings

Narrow View of Extensions Disapproved.—In ordering the Greensboro Gas Company to make extensions under certain conditions the Pennsylvania Public Service Commission said: "The question to what extent a public utility shall operate its service within its chartered territory cannot be too narrowly segregated into the cost of the service to individual patrons or consumers, but utility operation should be viewed in its entirety and service accorded to all within the charter limits who desire it and to whom it can be furnished without placing an unreasonable burden upon the other ratepayers more favorably located for receiving the service."

No Discrimination Between Stockholders and Non-Stockholders Permissible.—Refusing permission to the Big Suamico Telephone Company to increase its rates to customers who do not hold stock in the company, the Wisconsin Railroad Commission said: "This request in so far as the applicant, with its limited number of subscribers, is concerned may not be unreasonable; but if the practice were permitted in this special case, it must be extended to all other public utilities. We cannot conceive that the practice can be universally adopted by utilities and administered without serious discriminations. The stockholders may through their board of directors meet at stated intervals and declare a dividend to stockholders, provided, however, such dividend has been actually earned."

Securities with an Element of Speculation Should Not Be Sold to Small Investors.—Other Principles Governing Issues.—Granting with certain restrictions an application of the Northwestern Public Service Company for authority to issue stocks, bonds and notes, the Nebraska State Railway Commission said that the public is interested in the securities of a utility to the degree that the financing will not be so liberal as to jeopardize the securing of funds in the future to meet the service obligations to the public, and the law presumes a reasonable scrutiny in the interest of the investor. Any speculative proportion in the acquisition of properties where such expansion is not made for the purpose of meeting the public service obligation, the commission said further, should be represented in such securities as do not ordinarily get into the hands of small investors, particularly when customer ownership of preferred stock is recognized as advisable. A further decision made by the commission was to the effect that an application by a foreign utility corporation for authority to issue bonds and preferred stock for the acquisition of property in another state, involving a mortgage on property within the state where the application is made, should not be denied on the ground that the corporation has outstanding no-par-value stock which is legal in the state of organization but prohibited to domestic corporations in the state where the application is made, especially when present practical considerations require that imperative financing shall not be interfered with by litigation on this issue.

Room Basis Versus Active-Load Basis.—In granting permission to the Darlington Electric Company to discontinue electric lighting schedules constructed upon the active-load basis and to substitute therefor schedules constructed upon the room basis, the Wisconsin Railroad Commission said: "The schedules suggested by the applicant are a decided departure from those now in effect. The change is desired by the company because of the difficulties encountered in attempting to administer active load schedules. The difficulties are especially pronounced in the application of such schedules to residence lighting. Not only are there objections from the customers to the inspection of their premises by the company in order to determine the connected load, but the costs of administration are considerable because of frequent inspections, if the accounts are to be kept up to date and discrimination avoided. On the other hand, when the room basis is once established, there is little occasion for changes."

Recent Court Decisions

Writ of Certiorari to Review Rate Decision of Commission Refused.—The Mutual Light & Water Company obtained a writ of certiorari to review an order of the Georgia Public Service Commission lowering rates, and the city of Brunswick, Ga., opposed it. Certified questions from the Court of Appeals to the Georgia Supreme Court were answered as follows, the right to review being denied: "Where a municipal corporation of this state filed a petition with the Georgia Public Service Commission to revise and lower the rates charged for electric lighting and power in the municipality by a public service corporation engaged in furnishing electricity to the public, subject to the jurisdiction of the commission as to the rates, and where the commission issued a rule nisi requiring the public service corporation to show cause why the rates should not be revised, and where that corporation filed its answer in opposition to any lowering of the rates, with a cross-prayer for the raising of the rates, and where the issue thus formed came on to be heard regularly before the commission, when the municipality and the public service corporation both appeared, announced readiness for trial, introduced evidence and presented arguments in behalf of each respectively, and where in such cause an order adverse to the company was rendered by the commission, lowering the rates until the further order of the commission, the writ of certiorari will not lie from the superior court to such order and judgment for the purpose of correcting alleged errors therein, at the instance of the public service corporation, the act of rate making being legislative or quasi legislative in character." (124 S. E. 178.)*

Option on Purchase of New Municipal Plant Not Indebtedness.—The municipal authorities of Middletown, Del., entered into an agreement with manufacturers to install new lighting and pumping equipment on the site of the present municipal plant. The agreement provided for a further contract in the form of a lease to be executed between the parties, effective upon the completion of the plant. The lease is to run for a period of one year commencing May 1, 1924, and the town is obligated to pay a monthly rental of $946.40. The town is to be given the option to lease the plant for a second or third year at a like rental. The lease is also to provide that the town may purchase the equipment at the end of the first year for $21,598.25, and if it renews the lease it may purchase the plant at the end of the second year for $11,140.01 and at the end of the third year for $1. A bill for an injunction was brought (Cochran vs. Mayor) on the ground that the agreement was a subterfuge to carry the indebtedness of the town beyond the limit fixed by the Legislature, but the Delaware Court of Chancery has denied the plea, holding the transaction to be within the city's rights and not an evasion of the law. (125 At. 459.)

Power of Irrigation District to Divert Water Where Others Have Riparian Rights Denied.—The Superior Court of Shasta County, Cal., has decided in favor of the Mount Shasta Power Corporation, now part of the Pacific Gas & Electric Company, a suit brought against it by the Fall River Irrigation District in a case of state-wide interest to power companies and others. The irrigation district, claiming the right to divert 500 sec.-ft. of Fall River—one-third of the stream flow—for irrigation purposes, brought the suit to determine its right as against the company's contention that it was entitled to the entire flow of the stream at the intake of its tunnel diverting Fall River to Pit No. 1 power house. The company, having acquired all the riparian rights along Fall River from its confluence with the Pit River up stream to the intake of the company's tunnel, held that it was entitled to the undiminished flow of the river, except for the part that might be used upstream for domestic purposes and the watering of stock. If the district should have the right to divert one-third of the stream for irrigation purposes upon non-riparian lands, the usefulness of the company's great power development would be greatly impaired. Most of the facts were agreed upon by the contestants, the issue being almost entirely one of law. The case will be taken to the California Supreme Court for final adjudication.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Industry Approves Election

Expressions by Electrical Men Show Conviction on Their Part that the Re-election of President Coolidge Will Renew Confidence in the Stability of Business

INASMUCH as the last few weeks had shown business decidedly hesitant and non-committal as far as new projects were concerned because of the approaching election, the following expressions of men in the electrical industry are interesting because they indicate the conviction that complete confidence in the stability of business will now be restored. The ELECTRICAL WORLD, desiring to put this widespread opinion on record, obtained statements from representative men of the industry. The sentiment is unanimously expressed that there will be a renewal of business and, the vote having proved that President Coolidge has to an unusual degree the confidence of all classes of people, all doubts concerning its stability are set at rest. The sentiment of the country is shown to be conservative, and the business men of the electrical industry anticipate and plan for a continued increase in all lines of business.

A. D. Curtis, president Curtis Lighting, Inc., Chicago.—"We are assured by the results of the election of our Magna-Charta rights to conduct our own businesses at least four more years. The electrical industry will undoubtedly make undreamed-of advances in all branches, particularly in the lighting field. The universal recognition of better lighting as an absolute necessity convinces us that this branch of the art will not lag."

Neil C. Hurley, president Hurley Machine Company, Chicago.—"It is a great relief to have any election over, particularly one where an attack has been made on private ownership of public utilities. The electrical business is so closely associated with the American people through its service that the possibility of any legislation adverse to present friendly relations would retard development of our great industry. I look for substantial improvement in our business from now on."

H. W. Bliven, vice-president Harvey Hubbell, Inc., Bridgeport, Conn.—"We believe that the election results will so stabilize the electrical industry that we may confidently look forward to a long period of steadily increasing business."

Walter A. Bates, vice-president Bates Expanded Steel Truss Company, Chicago. — "I believe the election of Coolidge and Dawes means that uncertainty is now eliminated and that all industry, especially the electrical, which has been most steadily progressing, will immediately begin a safe, steady course to sane prosperity. We should no longer fear government interference with public utilities, but may instead expect co-operation."

J. M. Livingston, sales manager Electric Power Equipment Corporation, Philadelphia.—"We are confident that the results of the election with an impressive Coolidge victory will be indicated in renewed confidence tremendously affecting the electrical industry. Unlimited capital can now be secured with confidence, resulting in increased purchases of power-house equipment and large transmission-line extensions."

T. J. Kauffman, treasurer and general manager Square D Company, Detroit.—"While our business has been good all year we expect immediate improvement as a result of the election. The branch of the electrical industry with which we are identified will benefit immediately."

Calvert Townley, assistant to the president Westinghouse Electric & Manufacturing Company.—"We believe that the election goes a long way toward settling any anxieties that business may have had as to the future course of the government. We know that President Coolidge in the White House will insure a continuation of the policy 'More business in government and less government in business.' The electrical industry is prosperous, and we anticipate a steady continuation of the annual increase over a term of years which up to now has been practically continuous. The election sets at rest any fear of instability."

George A. Hughes, president Edison Electric Appliance, Inc., Chicago.—"The result of the elections both here and in England indicates that the World is recovering from restlessness and radicalism of the war aftermath. This cannot help affecting general business favorably, and while there will probably be no boom, we look for a steady progress particularly during the coming year. The entire electrical industry should be jubilant of the overwhelming indorsement of President Coolidge's opposition to public ownership."

C. L. Pierce, Jr., manager electrical materials department, Hubbard & Company, Pittsburgh.—"I believe the election will hasten true public ownership of utilities—that is, complete customer ownership. Through customer ownership will come the capital necessary to complete the program of giant power stations which will widen the use and lower the cost of electricity. This will bring increased prosperity to the power company, the manufacturer and the owning public, all of which compose the electrical industry."

H. W. Young, president Delta-Star Electric Company, Chicago.—"Observation of the average business man on his way to work Wednesday morning furnished unmistakable proof of the election's effect on the minds of men and the consequent effect on business. The psychological jam is broken and the electrical industry will benefit more than any other, because there is more work to be done."

Edmund Lang, president Crocker-Wheeler Company, Ampere, N. J.—"The nation has overwhelmingly indorsed the administration and leadership of President Coolidge and has coincidentally elected as vice-president a business man and financier of broad experience. The business of the government in the next four years will undoubtedly be conducted in a most intelligent and effective manner. The productive forces of the nation, both industrial and agricultural, which underlie all prosperity will receive the greatest possible encouragement and protection from unsound legislation. The electrical industry will participate in these benefits."

G. S. Crane, general sales manager Cutler-Hammer Manufacturing Company, Milwaukee.—"We consider that the Coolidge election as well as the recent English election indicate a sane trend of thought throughout the world which will gradually result in improved conditions everywhere. We look forward with confidence for a marked increase in the amount of electrical power used and a prosperous era for the electrical industry."

John C. Barry, vice-president General Electric Company.—"Buying for the last four months has in general been on a hand-to-mouth basis, and stocks have been greatly depleted. In my judgment the national election will restore confidence and result in a substantial increase in business, especially in the electrical industry, as capital is available in large amounts and at reasonable rates for sound investments."

R. G. Widdows, sales manager Electric Controller & Manufacturing Company, Cleveland.—"The election of the Republican ticket will undoubtedly result in good business for some time to

come. The improvements should be gradual and of a healthy nature. The result of this election was not discounted to the same extent as previous presidential elections, and the benefits to be derived are therefore still ahead of us."

E. B. Seitz, executive secretary Washing Machine Manufacturers' Association, Chicago.—"The overwhelming vote of confidence given the present conduct of governmental affairs and the administration policy of 'more business in government and less government in business' will have an immediate salutary effect. Doubt being removed, plans for necessary expansion to keep pace with America's electrical needs will move forward briskly. We anticipate an unparalleled era for the manufacture and merchandising of electrical household appliances."

James R. Kearney, director of electrical sales, W. N. Matthews Corporation, St. Louis.—"We look forward to a marked extension of activity in the electrical field. During the coming year there will be an expansion of existing properties as well as the development of new enterprises. The uncertainty always preceding elections now being removed, these developments will proceed with confidence."

E. W. Rockafellow, vice-president National Pole Company, New York.—"I believe that with the election out of the way projects that have been held up will go forward and that 1925 will be one of the biggest years for the electrical industry we have ever had. With the acceptance of the Dawes plan by the European nations stability in European affairs will naturally react favorably here. One thing this election proves, and that is that the business world has gone back to the fashion of bygone days in holding up enterprises until the people know who is to be in power for the next four years."

Edwin B. Gillinder, president Gillinder Bros., Inc., Port Jervis, N. Y.—"The election of Coolidge means a continuation of a safe and sane program, and conditions as they exist today will not be disturbed. There is every reason to believe that business will improve and 1925 will be a better year than 1924."

R. C. Lanphier, vice-president Sangamo Electric Company, Springfield, Ill.—"The election of Coolidge and Dawes assures the country the continuation of the safe, conservative but forward-looking policies which have characterized Coolidge's administration. The electrical industry may, therefore, proceed with safety and absolute confidence in its wonderful program of expansion and of greater service to the entire country."

F. M. Bernardin, president the B-R Electric Company, Kansas City.—"The American people made the decision Tuesday that they were expected to make. They turned back the move of radicalism menacing the country. Now that the result is definitely known, hesitancy due to the election is over, and we can confidently look forward to a period of great improvement in the electrical industry."

Frank D. Van Winkle, president Post Glover Electric Company, Cincinnati.—"The election of Tuesday brings assurance that, at least for a time, the development of our industry will be along economical, not political lines. The voters have indorsed individual enterprise, and I believe every branch of our industry will take courage and renew its effort for a brighter tomorrow."

Better Business Policies Needed*

Electrical Manufacturing Industry Has Not Benefited from Its Own Accomplishments in Reduction of Manufacturing Costs

BY A. H. TIMMERMAN
President Electric Power Club, Vice-President Wagner Electric Corporation

DURING the past fifteen or twenty years we have seen many changes in the electrical industry. These changes have involved much in the way of design which has tended toward the reduction of both productive labor and material and in turn toward reduction in the dollars over-

A. H. TIMMERMAN

head per electrical unit produced. Standardization, and particularly that carried on by the Electric Power Club, has been a leading factor in the reduction of cost. In the industry a continuous reduction in the cost of manufacture is taking place, due to rapidly changing commercial conditions.

There is no question that reduced costs and selling prices have under normal conditions helped greatly to stimulate the introduction of electrical apparatus, and thereby the industry, as well as the public, has been benefited very much. Has the industry as a whole, however, received a fair return for its efforts and accomplishments? It sometimes seems to the writer that when any great advance in the art has taken place the electrical manufacturer has proceeded at once to give to the public not only 100 per cent but probably 105 per cent of what has been gained. In other words, the public has been receiving an undue proportion of the benefits derived from the efforts of the electrical manufacturing industry, the costly product of its large staffs of designing and research engineers.

May I allude here to one change which occurred ten or twelve years ago and well illustrates the statement made above? It was determined in our research laboratories that it is possible to operate certain grades of insulation continuously at a temperature of 105 deg. C. This resulted in the introduction of the so-called "50-deg. single-rated motor." What was the result of the introduction of this motor? Did it bring a greater return to the electrical manufacturing industry as a whole? Quite the contrary. When placed upon the market it was sold at a reduced price. This reduction in price naturally seriously affected the whole industry. To a large part of the buying public, a 10-hp. motor is a 10-hp. motor, whether its temperature rise is 30, 40 or 50 deg. C., with the result that certain manufacturers found it necessary, in competition, to meet the 50-deg. motor with a 40-deg. motor at the same price. This was only a natural result, as we should have foreseen.

Under present trying commercial conditions, accompanied as usual by very keen competition, prices have gone downward and downward until the margin of profit, though good in some lines of apparatus, in others is small and in still others is negative in value; and many manufacturers are making little or no profit on their total combined business, even with competent executive, engineering, manufacturing and sales organizations.

Our engineering and shop organi-

*Abstract of address made before the meeting of the Electric Power Club at White Sulphur Springs, W. Va., October 20-24, 1924.

zations have done much toward the reduction of costs by the introduction of new designs and new manufacturing methods, and it behooves us to consider at this time what our commercial organizations have done for the industry. Have they also improved in their selling methods? Do they steadily show a consistent reduction in selling costs, and if not, why not? We have gone to great expense in the direction of analyzing manufacturing costs, from both the design and the manufacturing standpoint, but what has been accomplished, if anything, in similar investigations of selling costs?

The Electric Power Club has done much toward technical standardization and has in this way very materially aided in the reduction of manufacturing costs. What has it done, however, toward the reduction of selling costs? What has it done in the direction of better business practices? If it has aided materially in the direction of manufacturing conditions, why has it apparently failed in the improvement of commercial conditions? Realizing what technical standardization has done, not only for the industry but also for the public at large, in the reduction of cost, are we not entitled to draw the conclusion that better commercial practices, the ethics of which are not questionable, will result in corresponding benefits, not only to the industry, but also to the public at large? Why, then, have we done so little in the direction of following better business practices? Why have we done little or nothing in the direction of reduction of selling costs?

Distribution Costs Should Be Carefully Analyzed

We have under consideration at present the question of employment of an accountant, or accountants, for the development of our manual in the direction of refinements in cost accounting for the various branches of the industry. Is it not high time that, instead of going to such refinements, we spend the same energy in showing how we can save in the cost of distribution of our apparatus rather than in still greater refinements in manufacturing operations? We must not overlook the fact that an accurate knowledge of costs, in the broader sense, does not under present conditions tend toward commercial stabilization. In fact, a broad knowledge of costs may tend in the opposite direction. If the Electric Power Club cannot be a real factor in the improvement of existing commercial conditions, it has certainly failed in one of the most important functions of such an organization.

Price Cutting Unfair

We hear complaints on all sides of many, to me, unethical practices. These complaints come from both the large and the small, as well as the intermediate-size, manufacturers and in turn are directed against all three classes. I think we have all had the experience at some time in our career of having bought material at a lower price than that for which it was first offered for sale. This always leaves a question of doubt in the mind of the buyer as to whether he paid not only the bottom price but a just price for the material purchased. It is said that today there is no bottom price for electrical apparatus, that all that is necessary is for the buyer to say that he has a price so many per cent lower than the price asked and the manufacturer will come through with a lower price. Are we giving our customers a square deal when through pressure of competition we give one buyer a lower price than another for identical apparatus and essentially the same volume? Are we justified in believing, without proof, that the buyer has a lower price? Many buyers seem not to know that the ethics of business include common truth telling.

There are other similar abuses which need frank discussion. They are customs which have grown up in the industry and which probably seem perfectly ethical to those who have been using such methods to their advantage, and these are not confined to companies of any particular size.

Do such abuses and conditions exist in other industries? In some, yes. The electrical industry is by no means the only one facing serious commercial problems. There are, however, other industries which are so organized and directed as to have eliminated to a large extent such unethical practices. The steel industry is a shining example of one which has thrown overboard many unethical methods.

It seems particularly unfortunate and remarkable that an industry which prides itself on having so many technically trained men should be satisfied to move along in the present groove of commercially unethical practice, with a resultant lack of profit in many lines.

We are told that industrial organizations must do nothing which savors of price agreements or engage in any discussions which may be remotely interpreted as leading to an understanding on prices, and that the interpretations of the anti-trust acts by the Supreme Court are becoming more and more drastic in this direction. On the other hand, the United States government recognizes the right of public service corporations to make a fair return on the investments as exemplified by the fixing of freight rates on a basis of a high wage to railroad employees and a small return on invested capital. This right is further recognized by the state governments in fixing the rates at which electric light and power companies not only may, but must, charge for power furnished to customers connected to their lines.

Government Co-operation Should Be Given

In other words, the federal and state governments protect the investors in the stocks and bonds of such corporations as are engaged in public service work. Why, then, should the government not recognize the right of the manufacturing industries to a proper return and initiate such laws as will enable them to make a fair profit and, on the other hand, repeal such laws as prevent proper returns? Why should the federal government force all of us to pay excessive freight and passenger rates in order to pay abnormally high wages to railroad employees, on the one hand, and at the same time pass laws which will prevent industrial enterprises so to organize as to treat their employees with the same degree of liberality?

Wherein are the employees of railroad and other public service corporations so much superior to those engaged in industrial work? Why is it that such a large percentage of all business started fails within three years of formation? It is not reasonable to assume that incompetence is by any means the cause of all such failures. The public generally is rapidly becoming the owner of a larger and larger proportion of industrial stocks. May we not hope that the recognition of its right to a square deal is not far off?

Business Conditions

NOW that the election has been definitely settled and manufacturers have expressed complete satisfaction as to the results, there no longer remains the element of doubt which unquestionably asserted itself in withholding action on many projects which might otherwise have been consummated. Therefore, while business has been good and has been showing slow but steady improvement, there is no reason now why further and larger improvements should not be steadily noted.

Though recent reports of decrease in sales have been made by many electrical manufacturers, it must not be forgotten that the business of the industry has been trending steadily upward over a term of years. That utility security issues of the Brooklyn Edison Company and the Standard Power & Light Corporation were recently placed on the market and readily absorbed indicates the confidence of the public in the industry. Central-station companies in most sections of the country continue to be active in construction work, and many orders for auxiliary apparatus are being placed by them with requests for immediate delivery so as to meet the power demands. Improving conditions are also shown in the growing demand for iron and steel, the October iron output being 17 per cent higher than in September. The increasing foreign consumption of the non-ferrous metals shows increasing manufacturing activity abroad, which should further help to improve business here.

In the New England district better business has been widely reported, and increased activity has been noticed in supply lines, with poles and cross-arms in good demand. A good volume of business is being transacted in the New York district, and industrial firms are continuing to purchase maintenance materials in quantities which in the aggregate are large. In the Southeast trade has been moving along with an even trend, and it is in greater volume and healthier condition than at the same time last year. Insulator buying was prominent in the trade of the Middle West, with general sales quite satisfactory. On the Pacific Coast business is improving. The defeat of the water and power act in California and the Bone bill in Washington is very encouraging to the electrical industry.

Standards of Battery Advertising and Sales Practice Improve

"STANDARDS of battery advertising and sales practice have been materially raised during 1924 through an intensive campaign of education and publicity," according to Harry G. Robbins, chairman of the National Vigilance Committee of the Associated Advertising Clubs of the World.

"The consistent growth of the battery industry," says Mr. Robbins, "bears testimony to the fact that the public appreciates these efforts and responds to them. A few battery advertisers who failed to recognize the moral responsibility which rested upon them are being weeded out by the committee in co-operation with better business bureaus in forty American cities. Most of these advertisers were guilty only of deception—often unintentional—and needed only to be educated up to the standard.

"Doubtful and extravagant statements in advertising have been investigated, either nationally or locally, as soon as they appeared. If the tests of the committee or the better business bureau proved them truthful, the advertiser received written acknowledgment to this effect. Only in those rare cases where the advertisement could not be substantiated and where the advertiser refused to mend his ways has the National Vigilance Committee resorted to prosecution. In general the work of the committee has made the industry realize that public confidence in it and the confidence of its members in one another is too priceless a thing to be trifled with."

Electrical Exports Decrease During September

SHIPMENTS of all classes of electrical goods during September, 1924, were much below those of August, preliminary returns showing a total for September of $6,108,639 as compared with $7,188,870 for the preceding month, according to the Electrical Division of the Department of Commerce. The total is, however, almost $200,000 above the value of electrical exports during September, 1923. On the whole there was a considerable decrease in the generating equipment and transformer classes, the exception being in steam turbine generator sets, which showed a slight increase. Wiring device and wiring material shipments also increased, while radio and wireless apparatus exports continue to grow. The complete list is given in the table below.

VALUE OF ELECTRICAL EXPORTS FOR SEPTEMBER, 1924, COMPARED WITH CORRESPONDING MONTH IN 1923
(Issued by Bureau of Foreign and Domestic Commerce)

	September 1923	September 1924
Generators:		
Direct-current:		
Under 500 kw.	$51,341	$58,739
500 kw. and over	25,109	57,970
Alternating-current:		
Under 2,000 kva.	4,816	14,811
2,000 kva. and over	211,391	11,912
Steam turbine-generator sets	*	37,572
Accessories and parts for generators	98,784	38,526
Self-contained lighting outfits	18,354	64,168
Batteries:		
Flashlight	*	48,779
Other primary	90,037	59,470
Storage	172,743	245,977
Transforming or converting apparatus:		
Power transformers	286,126	143,835
Other transformers	52,549	104,176
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	88,346	52,026
Transmission and distribution apparatus:		
Switchboard panels, except telephone	39,297	274,544
Switches and circuit breakers over 10 amp.	127,910	118,444
Fuses and fuse blocks	24,485	22,038
Watt-hour and measuring meters	48,304	87,894
Volt, watt, and ampere meters and other recording, indicating and testing apparatus	57,106	95,791
Lightning arresters, choke coils, reactors and other protective devices	42,919	53,556
Motors, starters and controllers:		
Motors, under 1 hp.	142,566	129,349
Stationary motors—		
1 to 200 hp.	348,318	141,161
Over 200 hp.	67,513	45,556
Railway motors	150,487	53,894
Electric locomotives:		
Railway	260,000	453,223
Mining and industrial	66,452	15,411
Other motors	19,577	†
Starting and controlling equipment for:		
Industrial motors	*	71,463
Electric railway and vehicle motors	*	1,647
Rheostats, controllers and other starting and controlling equipment	150,499	†
Accessories and parts for motors	168,963	138,683
Electric fans	$58,886	$33,621
Electric lamps:		
Incandescent:		
Carbon-filament	3,260	5,369
Metal-filament	72,441	69,097
Other electric lamps	25,704	24,837
Flashlights	$34,934	$63,206
Searchlights and projectors	35,431	53,237
Motor-driven household devices	61,948	44,618
Domestic heating and cooking devices	82,379	83,047
Industrial electric furnaces and ovens	27,367	11,627
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	64,888	83,208
Signal and communication devices:		
Radio and wireless apparatus	258,967	567,434
Telegraph apparatus	21,668	60,833
Telephone apparatus—		
Magneto telephones	9,818	13,126
Other telephones	73,249	37,088
Magneto switchboards	232	236
Other telephone switchboards	29,960	47,832
Other telephone equipment		188,903
Railway signals, switches and attachments	69,800	56,338
Bells, buzzers, annunciators and alarms	6,540	14,481
Other electric apparatus:		
Spark plugs, magnetos and other ingition apparatus	210,450	109,556
Insulating material	77,635	113,791
Metal conduit, outlet and switch boxes	25,136	47,069
Sockets, receptacles and lighting switches	83,994	116,766
Other wiring supplies and fixtures	138,806	†
Electric lighting fixtures, interior and street		54,651
Other wiring supplies and line material		92,818
Other electrical appliances not elsewhere specified	756,642	534,967
Globes and shades for lighting fixtures	34,630	32,335
Electrical glassware, except for lighting	16,629	19,047
Electrical porcelain	109,802	134,276
Electrical carbons, carbon brushes electrodes	232,151	197,148
Insulated wire and cable (iron and steel)	73,324	17,991
Other manufactures of aluminum	75,232	82,170
Copper, bare wire	98,794	180,945
Copper, insulated wires and cables	232,408	276,326
Total electrical machinery and apparatus and supplies	$5,917,097	$6,108,639

* Not separately stated prior to January 1, 1924. † Discontinued beginning January 1, 1924.

Prices of Copper, Tin and Zinc Continue to Advance

THE non-ferrous metal markets have been active all week, not only here but also abroad. With the re-election of President Coolidge both the buyers and sellers of metal are expecting increased prosperity. Copper, zinc, antimony and tin prices have all advanced during the last week while lead has held its recent advances. Producers of copper have continued reluctant sellers except at gradually advancing prices, the demand for the metal being in good volume both for foreign and domestic consumption. The tendency now is to ask higher prices for forward deliveries of more than two months and also for points that take a comparatively high freight rate. Brass companies are active in the market for copper to take care of their increasing bookings. The copper and brass industry appears to be in a very healthy position with no unfavorable reactions in sight as a result of the recent advances.

NEW YORK METAL MARKET PRICES

	Oct. 29, 1924 Cents per Pound	Nov. 5, 1924 Cents per Pound
Copper, electrolytic	13.55	13⅜–13½
Lead, Am. S. & R. price	8.65	8.65
Antimony	11¾	12¼
Nickel, ingot	29–30	29–30
Zinc, spot	6.85	6.92½
Tin, Straits	52¼	53¼
Aluminum, 98 to 99 per cent	28	28

Lead remains unchanged in price with the conditions the same—the supply being less than the demand. A very small tonnage has sold in New York at 9 cents as producers cannot yet meet the requirements from all sources. Sales of the metal abroad remain very good. Fair tonnages of zinc have been purchased by galvanizers. The outlook is extremely good, and with Europe demanding supplies of zinc the price has again advanced. The demand for tin has continued on a satisfactory scale with forward deliveries commanding the same price as prompt ones.

Trade in the Southeast in Greater Volume—Conditions Better

IN THE Southeast business has been moving along with an even trend, no unusual activity being reported by electrical interests. Trade generally throughout the section is in greater volume and healthier condition than at this time a year ago, and indications are that money that is being realized from the marketing of crops—which are in good shape—is resulting in more optimism than has been evidenced for some time past. An increasing number of inquiries is reported from both the central-station and industrial fields, with purchases by central stations very satisfactory.

Jobbers report an encouraging volume of orders from industrial firms, several of which were of considerable size, and other jobs are in the process of being figured. One of the largest central stations in the Southeast has just announced a plan for financing the electrification of existing industrial plants in its territory on long-term payments. This plan should produce a large volume of business in apparatus and heavy wiring lines within the next six months. The retail trade is being largely sustained by the very satisfactory activities in the appliance line and the extraordinary demand for radio equipment.

Buying in New England District Shows Improvement

BETTER business was widely reported in electrical circles in the New England district. An important order was placed by the Narragansett Electric Lighting Company of Providence with the General Electric Company for a 43,750-kva. steam turbo-generator. Industrial plant turbines are also in demand and two 750-kw. units have been purchased by the Mystic Iron Works of East Boston. Electric motor sales are showing more life after a long period of comparative quiet, one six-thousand-dollar order in units of 1 hp. to 20 hp. having been received from New Hampshire. A new street-lighting installation is under way at Lowell, Mass., as a part of a comprehensive rehabilitation program. The Boston Edison company is almost overwhelmed with new residential business, and the demand for telephone service is of record-breaking proportions. New England building contracts totaled $9,370,000 last week against $7,025,100 a year ago.

Jobbers report increased activity in supply sales. Poles and cross-arms are in great demand, one house having sold nearly $8,000 worth of poles in the past ten days. Two carloads of cross-arms went to Rhode Island and four carloads of iron conduit were purchased by a Boston engineering house for a power plant in Pennsylvania. Wire and fixtures are selling vigorously.

Good Volume of Trade in New York—Central Stations Active

BUSINESS in the New York district continues in good volume. Many propositions having been held in abeyance pending the outcome of the political contest, manufacturers feel that now that every element of doubt has been removed sales should show a steady increase. Within the last three or four weeks purchases of maintenance material by industrial firms have been large and have been steadily increasing. Jobbers report that their sales have continued to improve, and while this is always so at this period of the year, the total volume of business is a little more than is usual.

Central-station companies in this district are very active, and in the next few weeks many purchases of auxiliary equipment are expected. One utility is also planning to place an order for a large turbine in the very near future. This activity presages an increase in the consumption of electricity partly as a result of the increased amount of building construction. Eventually this means that many purchases of energy-consuming devices will be made. A utility is reported to be in the market for 100,000 locust pins. The demand for cross-arms and poles remains about the same.

Insulator Buying a Feature in the Middle Western District

THE spirit of cautiousness in business still prevailed to some extent in the Middle West, although not to so marked a degree as prior to the election. The result of the election has eliminated the disturbing influences, and there is every indication now that money will be forthcoming more freely than it has been recently for new purchases. The volume of business transacted remains quite satisfactory, with no unusually large orders being placed. Central-station construction continues brisk and programs for expansion are being outlined at the present time. The demand for pole-line hardware, insulators and similar material has been quite active. With few exceptions, very little other equipment has been purchased.

Steadily increasing business through the large Chicago mail-order houses indicates that the farmers of the Middle West are recovering from their depression and are now buying freely with the funds realized from the sale of 1924 crops. For instance, Montgomery, Ward & Company in October did a larger business than for any one month since its organization, running 13.83 per cent over the same month last year. Prices in general remain firm, with the exception of code wire, which advanced approximately 5 per cent this week. Jobbers report an increasing amount of inquiries and look forward to better business after the election.

Trade Better on Pacific Coast—Water Power and Bone Bills Defeated

THOUGH crops were subnormal on the Pacific Coast, prices were much better than ordinarily, and the receipts are reflected in the improvement of interior business, especially in the Sacramento and Santa Clara Valleys. San Francisco building permits for October, 1924, totaled $6,116,313 in value, the highest month since the great fire reconstruction. Permits in October, 1923, totaled $3,793,374. No very large but many good-sized orders are reported since the first of the month, largely for standard lines. Among these is an order for several thousand dollars of rubber-covered wire and varnished-cambric cable.

Dealers report an improved market for vacuum cleaners and clothes washers, especially the better grades. Lamp sales are also very good, principally through two intensive campaigns, one by jobbers' salesmen for contracts and the other by dealers for consumers' contracts. Collections average a little higher than forty-five days and will at least maintain this average because of the customary end-of-the-year drive by credit men. The water and power bill providing for a half-billion-dollar bond issue for a state water-power system and a five-man commission to manage it was beaten by a two-to-one vote in northern and a three-to-one vote in southern California. The Bone bill, also in the interest of public ownership, was defeated in the State of Washington.

Activities of the Trade

Bates Starts Operation of New Galvanizing Plant

On November 5 the Bates Expanded Steel Truss Company, Chicago, started operating its own galvanizing plant, which has been recently constructed. This new plant is adjacent to the main steel-pole plant in East Chicago and contains pickling vats 38 ft. long and spelter kettles 25½ ft. long. The plant is equipped with five overhead electric carriage cranes.

The primary object in building its own galvanizing plant, according to Albert J. Bates, Jr., secretary, was to serve its customers more readily and to increase production, as formerly it had been necessary to send all material to outside companies for galvanizing. The Bates company is also now in a position to render a galvanizing jobbing service to other manufacturers.

Frank Adam Electric Company Sells Part of Its Business to Employees

Announcement has been made by the Frank Adam Electric Company, St. Louis, that it has sold out its electric appliance retail business to Arthur C. Brandt, who has been manager of this department for the last nine years. This is in accord with the company's policy to concentrate on its manufacturing lines. Its electrical contracting department has also been sold, to the W. C. Burton Electric Company, Mr. Burton having been the company's estimator and solicitor up to about three years ago. The old manager of the contracting department has associated with Mr. Burton in now continuing the wiring business under the name of the W. C. Burton Electric Company.

The main business of the Frank Adam Electric Company was electric wiring and contracting when it was first incorporated about 1889. In 1895 the company went into the electric lighting fixture business. It had always run a small shop and made its own switchboards and panelboards, but in 1900 it bought out the switchboard department of the Emerson Electric Manufacturing Company, which had an established business in the manufacture of switchboards, knife switches and panelboards. The company was one of the first contractors who sold electrical appliances, probably starting in as early as any of them in the United States handling the Simplex line.

In 1911 the company's manufacturing department reached such proportions that Fred B. Adam, now president and general manager of the company, found it necessary to give the greater part of his time to this end of the business, and during the year of the war the entire construction work was left in the hands of the manager of the department. The retail fixture business in June of 1920 was turned over to E. C. Adam, brother of the president, who has been operating as the E. C. Adam Company, taking over all of the retail fixture business. The Frank Adam Electric Company is now only in the manufacturing business, manufacturing knife switches, light and power switchboards, panel boards and the inclosing steel cabinets for same.

Babcock & Wilcox to Operate Under Fuller-Lehigh Patents

The Fuller-Lehigh Company has just advised its New York office, at 50 Church Street, that it has entered into an agreement with Babcock & Wilcox, Ltd., London, England, to operate under the Fuller-Lehigh Company patents, whereby everything in connection with its pulverized-coal business in the various countries throughout the world will be handled by Babcock & Wilcox, Ltd., of London, with the exception of the United States, its dependencies, Canada and Mexico. The Babcock & Wilcox Company has taken over many members of the Fuller organization who have specialized for years in work of this kind so that it may have experienced engineers to handle this department of its business.

The agreement was concluded between the Fuller-Lehigh Company and Babcock & Wilcox, Ltd., in July, since which time the Babcock company has obtained a number of contracts in various parts of the world to equip boilers for operation with pulverized coal.

Westinghouse Receives Order for 12,500-Kw. Turbo-Generator

The third unit to be installed in the plant of the Columbus, Delaware & Marion Electric Company, Marion, Ohio, will be a 12,500-kw. Westinghouse turbo-generator. This unit will increase the total capacity of the plant to 22,500 kw. The generator will deliver power at 80 per cent power factor, 13,200 volts, three-phase and 60 cycles. The turbine will operate under 250 lb. steam pressure at 200 deg. F. superheat and with a 28-in. vacuum. A Westinghouse surface condenser of 20,000 sq. ft. and auxiliaries will serve the turbine.

The Acme Wire Company, New Haven, Conn., announces the opening of a Boston office at Room 442, Chamber of Commerce Building, 80 Federal Street, in charge of R. M. Nichols.

The Hoover Company, North Canton, Ohio, manufacturer of vacuum cleaners, announces the observance of Hoover week from December 6 to 13. The feature of the week is a competition for thirty cash prizes which are awarded to the makers of the most effective Hoover window displays.

The New Era Electric Manufacturing Company, 4121 Woodland Avenue, Cleveland, manufacturer of switch boxes, metal covers and outdoor lighting equipment, has plans under way for the erection of a one-story addition, 50 ft. x 83 ft.

The Gibb Instrument Company, Bay City, Mich., manufacturer of electric welding and electric heating equipment, announces the appointment of H. V. Beronius as its representative in Iowa, Kansas, Nebraska, Oklahoma and northwestern Missouri. Mr. Beronius will have his headquarters at 33 Linwood Terrace, Kansas City, Mo.

The Austin Company, Cleveland, engineer and builder, announces the removal of its San Francisco office to greatly enlarged quarters at 244 Kearny Street. Recently the headquarters staff of the Austin Company at Los Angeles moved into its new home at 777 East Washington Street, a private office building, two stories high. The Austin Company reports greatly increased activity in the Bay District, one of the projects of the San Francisco office now under way being the new plant of Hubbard & Company, Oakland, Cal.

New Equipment Available

Butt-Welding Machines

Two electric welding machines incorporating automatic features have been placed on the market by the Thomson Electric Welding Company, Lynn, Mass. The machines are known as the models 15 and 25 SP butt welders. The model 15 butt welder may be equipped for welding stock of any ordinary cross-section the area of which is not less than 0.10 sq.in. nor greater than ½ sq.in. A 62-kva. transformer is provided for operation on the usual commercial alternating-current lines. In operating the machine the parts to be welded are inserted and clamped by hand. In the model 25 SP butt welder the work is clamped by means of air pressure, eliminating fatigue of the operator from this source. This model is also intended for welding iron or steel parts of the same cross-section.

Flexible Coupling

A flexible coupling of the pin and bushing type that compensates for both angular and off-center misalignment and allows free end float of the connected shafts is being placed on the market by the Terry Steam Turbine Company, Hartford, Conn. The flanges are made from special-composition steel forgings and are completely machined. The bushings are made from a uniform grade of rubber. The coupling requires no lubrication, is designed to operate in either direction and requires no special tools in order to be disconnected. Couplings are available in capacities up to 400 hp. per 100 r.p.m.

New Trade Literature

VOLTAGE TESTER.—The Square D Company, Detroit, has issued a leaflet entitled "Bidding Goodbye to Test Lamps," in which it describes the "Wigginton" voltage tester recently developed by the company.

CONDUIT FITTINGS.—The Multi Electrical Manufacturing Company, 1848 West Fourteenth Street, Chicago, has issued catalog No. 3, covering its "Powerlet" products, including the oblong, switchbox, round and midget series and conduit series, and also its "Multi" line, including porcelain bushings, porcelain and slate cut-outs, fuse clips and set screw connectors, etc.

CRANES. — The Milwaukee Electric Crane & Manufacturing Company, Milwaukee, has published a booklet covering different types of the "Milwaukee" cranes. Numerous illustrations are given showing various installations of the cranes.

IRON AND STEEL FOR ELECTRICAL PURPOSES.—"Iron and Steel for Electrical Uses" is the title of a booklet issued by the American Rolling Mill Company, Middletown, Ohio, which gives the history, manufacture and magnetic properties of "Armco" electrical sheet steels and "Armco-Ingot" iron, bars, wire and cold-rolled strip.

ENAMELED RESISTOR UNITS.—Bulletin No. 48,941A, entitled "CR-9006 Enameled Resistor Units," issued by the General Electric Company, Schenectady, N. Y., describes the uses and advantages of these units and gives standard ratings and dimensions.

FLASHERS.—The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing bulletin No. 501, in which it calls attention to how animation and colors are used to double the effectiveness of window displays.

BRASS PRODUCTS.—"Brass Facts" is the title of a booklet issued by the Scoville Manufacturing Company, Waterbury, Conn., which gives a brief description of the uses and methods of various brass alloys. It contains illustrations showing the microstructure of annealed as well as rolled brass and also a description of the method of manufacturing high-speed free-turning rod, naval brass rod, brass forging rod and brass forgings, cup-drawn "Admiralty" and special "Muntz" condenser tubing and seamless tubing.

FRICTION-HEAD SCREWDRIVER.—Bulletin No. 605 issued by the Hisey-Wolf Machine Company, Cincinnati, describes the Hisey friction-head screwdriver.

INSULATION.—"Fibroc Facts" is the title of a booklet issued by the Fibroc Insulation Company, Valparaiso, Ind. In this the company tells the composition of "Fibroc," the method of manufacturing the product and its various uses, including insulation, gears, switches, radio panels and base mountings, push-buttons, etc.

SELF-STARTING MOTOR.—The Triumph Electric Company, Cincinnati, is distributing a folder covering the "TR" constant-speed, polyphase, alternating-current self-starting motor, which is manufactured in sizes from 3 hp. to 125 hp.

SWITCH PLUG.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing catalog No. 7,020, describing the new Hubbell switch plug No. 7,020.

ELECTRIC RANGE. — The Michigan Stove Company, 3306 East Jefferson Avenue, Detroit, is distributing a folder calling attention to its new "Garland" electric ranges.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Prague, Czechoslovakia (No. 12,074), of electric drills.

Purchase is desired in Riga, Latvia (No. 12,069), of farm-lighting plants.

Purchase is desired in Barcelona, Spain (No. 12,070), of farm-lighting plants.

Purchase is desired in Amsterdam, Netherlands (No. 12,072), of amateur radio sending and receiving apparatus.

An agency is desired in Santiago, Chile (No. 12,004), for radio parts and sets, for belt, steam and direct electrically driven air compressors, crushers, roller screens and elevators, Diesel, kerosene and charcoal-gas engines and electric hoists.

An agency is desired in Sydney, Australia (No. 12,068), for radio sets and parts.

An agency is desired in Copenhagen, Denmark (No. 12,073), for radio sets and parts; vacuum cleaners (No. 12,019). Purchase is desired of radio sets and parts (No. 12,075).

An agency is desired in Brussels, Belgium (No. 12,071), for wiring material, switches, accessories and specialties.

New Incorporations

THE SOUTHEAST GEORGIA LIGHT & POWER COMPANY, Dublin, Ga., has been incorporated with a capital stock of $50,000 by James L. Murphy, John L. Maher and others.

THE IOWA POWER & LIGHT COMPANY, Des Moines, Iowa, has been incorporated with a capital stock of $6,000,000 to construct and operate electric plants, etc. The officers are: M. G. Linn, president; C. S. Bradshaw, vice-president; Rex H. Fowler, secretary, all of Des Moines, and P. C. Dings, treasurer.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

WILTON, ME.—Contract has been awarded by the Wilton Woolen Company for a hydroelectric power plant, to cost about $35,000, for service at its mills.

BOSTON, MASS.—A building permit has been issued to the Edison Electric Illuminating Company for the construction of a substation at 622 East First Street, to cost $40,000.

TAUNTON, MASS.—The City Council has authorized an appropriation of $19,000 for improvements to the municipal lighting system, including equipment for street lighting at the power station, an additional underground conduit and extensions for underground conductors for ornamental lighting system, etc.

Middle Atlantic States

BROCKPORT, N. Y.—Bids will be received until Nov. 17 by the Board of Water Commissioners, for the installation of electrical equipment in connection with improvements at the municipal pumping station.

GLOVERSVILLE, N. Y.—The Charles Vail Lumber Company plans to erect a power house in connection with the rebuilding of its local plant, recently destroyed by fire.

ITHACA, N. Y.—The New York State Gas & Electric Company has applied to the Public Service Commission for authority to erect transmission lines in the towns of Edmeston and Burlington and to exercise franchises granted by the town boards.

ITHACA, N. Y.—The New York State Gas & Electric Corporation has been granted permission to extend its transmission lines into the towns of Danby and in a portion of Romulus. It plans to build the line through Romulus immediately to supply street-lighting service in Willard.

MALTA, N. Y. — The Dwaas Electric Company, Hudson Falls, has applied to the Public Service Commission for permission to erect a distribution system in Malta and to exercise a franchise granted by the Town Board. Malta has not a post office.

MIDDLEBURG, N. Y.—The Public Service Commission has approved the sale of the property of the Middleburg & Schoharie Electric Light & Power Company to the Fulton County Gas & Electric Company, Gloversville. The latter company plans to erect a 22,000-volt transmission line from the terminus of its present line at Central Bridge to Schoharie, and from there to Middleburg, making twenty-four-hour service available.

MIDDLETOWN, N. Y.—Steps have been taken by the Park Circle Association for extension of the ornamental lighting system from Wickham Avenue to the Ontario & Western Railroad Station.

NEWBURGH, N. Y.—The City Council has instructed City Manager to secure estimates of cost for extending the ornamental lighting system on Broadway from West Street to the city limits.

NEW YORK, N. Y.—The Cerro de Pasco Copper Corporation, 15 Broad Street, plans to install electric power equipment in connection with its proposed new plant at its properties in Peru, South America, to cost about $400,000.

NEW YORK, N. Y.—The Star Company, 2 Columbus Circle, publisher, plans to install electric power equipment in connection with its purposed paper storage and distributing plant, to be erected at Fifty-fourth Street and Eleventh Avenue, to cost about $500,000.

NIAGARA FALLS, N. Y. — The Niagara Electric Service Corporation has been granted permission to extend its lines into the town of Niagara, north of the Lockport Road.

OGDENSBURG, N. Y.—Plans for the proposed plant to be erected by the International Feldspar Company, Buckingham, Quebec, west of Ogdensburg, for the manufacture of feldspar and quartz products, include a power house.

STOCKHOLM, N. Y.—Application has been made to the Public Service Commission by Edward C. Daniels, Potsdam, for permission to build an electric plant in the town of Stockholm and to erect a transmission line, about 10 miles long, to furnish electrical service. Stockholm has not a post office.

SYRACUSE, N. Y.—Improvements to the lighting system on Clinton Street are under consideration by the Clinton Street Improvement Association.

WORCESTER, N. Y.—The Public Service Commission has approved the purchase of the local electric plant by the Fulton County Gas & Electric Company, Gloversville.

ISELIN, N. J.—A petition is being arranged for presentation to the County Board of Electric Lighting Commissioners for the installation of an improved lighting system on important streets.

PERTH AMBOY, N. J.—Three estimates covering the cost of additions to the municipal electric plant and the installation of ornamental lamps on several of the streets have been submitted to the Board of Aldermen by Jay B. Franke, city electrician. The plans include the installation of an additional unit in the municipal electric plant and 123 ornamental lamp standards. The cost is estimated at from $89,822 to $97,229.

TRENTON, N. J.—Plans for the proposed linoleum-manufacturing plant to be erected at Hutchinson's Mills, Hamilton Township, near Trenton, by W. & J. Sloane, Inc., Fifth Avenue and Forty-seventh Street, New York City, include a power plant. The cost of the entire project is estimated at $500,000. Lockwood, Greene & Company, 34 Federal Street, Boston, engineers, will be in charge of the work.

ALLENTOWN, PA.—The installation of an ornamental lighting system on South Eighth Street is under consideration by the Department of Public Safety.

ALLENTOWN, PA.—Bids will be received by T. P. Wenner, secretary school district, until Nov. 11 for installation of an electric lighting system in the Stevens School building.

ERIE, PA.—Steps have been taken by the West Eighteenth Street Civic Club for the installation of an ornamental lighting system on that thoroughfare

KENNETT SQUARE, PA.—The Chester County Light & Power Company has purchased the properties of the Franklin Township Light & Power Company, Londonderry Township Light & Power Company, Elk Township Light & Power Company and the London Britain Township Power & Light Company. The Chester company contemplates transmission-line extensions in the different districts.

LANCASTER, PA.—Considerable electric power equipment will be installed in the new plant of the Liberty Can & Sign Company, on Plum Street, near New Holland Avenue, to cost about $300,000.

YORK HAVEN, PA.—The York Haven Paper Company contemplates the installa-

tion of additional electric generating equipment in connection with the electrification of a portion of its plant, to cost about $50,000.

HARRISONBURG, VA.—The Virginia-Western Power Company, Clifton Forge, Va., has applied to the City Council for permission to extend its transmission lines into Harrisonburg.

RICHMOND, VA.—The Virginia Railway & Power Company contemplates building two substations, one at Lamb Avenue and Fill Street and the other at 2,515 Grayland Avenue.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Nov. 25 for a quantity of electrical equipment, including resistance units, insulation, battery jars, rubber packing, brackets, extension bells, wires and cables (Circular S-1638).

WASHINGTON, D. C.—Bids will be received by the Commissioners, District of Columbia, until Nov. 19, for a quantity of electric wire and cable, as per specifications on file.

North Central States

DETROIT, MICH.—Contracts will soon be awarded by the Wayne County Road Commission, Real Estate Exchange Building, for miscellaneous lighting equipment, including conduits, switches, wiring, lamps, etc.

LOUISVILLE, KY.—Application has been made by the Kentucky Hydro-Electric Company, M. E. Taylor Building, to the Federal Power Commission for a preliminary permit for power developments on the Kentucky River in Madison, Jassimine, Clark, Estill and Lee Counties. The company proposes to construct a power plant at each of the existing navigation dams from Lock No. 8 to Lock No. 14, all to be interconnected and to furnish electricity to the distributing system of the company. The present plans provide for a development of 30,000 hp.

OWENSBORO, KY.—Plans are being considered for extensions to the municipal electric light plant, including the installation of a boiler and assesories, to cost about $20,000.

HOBART, IND.—The Calumet Gas & Electric Company, Gary, has applied to the Public Service Commission to cross certain streets in Hobart and to condemn property here for a right-of-way for its proposed 33,000-volt transmission line.

CHICAGO, ILL.—A building permit has been granted Joseph T. Ryerson & Son, Inc., Sixteenth and Rockwell Streets, for the erection of a one-story transformer station at their works.

DECATUR, ILL.—The Illinois Power & Light Company, Illinois Merchants' Bank Building, Chicago, contemplates extensive development of its power lines in and around Decature within the next three years, involving an expenditure of from $3,000,000 to $5,000,000. A substation will be erected near the I.T.S. shops, to cost about $1,000,000, which will be the center of the power lines that will connect Peoria, Bloomington, Springfield and Decatur. A transmission line will be erected from Decatur to Champaign and Danville. Peoria will be connected with the Keokuk power station.

FAIRWATER, WIS.—Plans are being considered by the Fairwater Electric Company for the construction of a new hydro-electric plant a short distance from the present station.

LONE ROCK, WIS.—The Wisconsin River Power Company, Madison, has authorized plans for the construction of a 33,000-volt transmission line from Avoca to Lone Rock, about 8 miles long.

MINNEAPOLIS, MINN. — The installation of ornamental lamps on several streets is under consideration by the City Council.

REDFIELD, IOWA.—The Iowa Electric Company, Cedar Rapids, has acquired the transmission system of the Redfield (Iowa) Power & Mill Company in Dallas and Guthrie Counties.

CARUTHERSVILLE, MO. — The Arkansas-Missouri Power Company, Blytheville, Ark., contemplates extensions to its local plant, including the installation of a 1,150-hp. engine.

MONROE, MO.—Bonds have been voted for $7,000, the proceeds to be used for extensions in the municipal lighting system.

WAKEFIELD, NEB. — The Wakefield Electric Company contemplates the rebuilding of its electric light plant, changing the system from direct to alternating current. The cost is estimated at $65,000.

Southern States

FRANKLIN, N. C. — Arrangements are being made for the construction of a municipal hydro-electric plant on the Little Tennessee River, 3 miles above the city. Roberts & Company, Atlanta, Ga., are engineers.

SALISBURY, N. C.—The Board of Aldermen is considering a proposal submitted by the North Caroline Public Service Company for the installation of an ornamental lighting system in the business district, covering eight blocks.

WEST POINT, GA.—Plans are under consideration by the Chamber of Commerce for the installation of an ornamental lighting system in the business section.

DELAND, FLA.—A special election will be held Nov. 28 to submit to the voters the proposal to issue $300,000 in bonds for construction of a municipal electric power plant and distributing system.

ST. PETERSBURG, FLA.—A movement is under way for an ornamental lighting system from Central Avenue to the Gandy Bridge. Robert H. Pollack and R. G. Carroll, 687 Central Avenue, are interested in the project.

WINTER HAVEN, FLA. — The budget for the ensuing year carries an appropriation for the installation of an ornamental lighting system across the city. The system will be installed by the Winter Haven Water, Ice & Light Company.

MOBILE, ALA.—A plan providing for the installation of an ornamental lighting system for the principal downtown and residential streets, covering 15 miles, will be submitted to the City Commission.

HELENA, ARK.—The Arkansas Utilities Company, Henena, is negotiating for the purchase of the local electric plant. It is proposed to erect transmission lines from Helena to Marianna for light and power service here and in intermediate towns.

DURANT, OKLA.—Bonds to the amount of $53,500 have been voted, of which $15,500 will be used for the installation of an ornamental lighting system and the remainder for extension to the waterworks.

HANNA, OKLA.—The Haines Light & Power Company, Fort Worth, Tex., contemplates the construction of an electric lighting plant and the erection of 10 miles of transmission lines to furnish power in Indianaola and Vernon.

OKEMAH, OKLA.—The Council is considering turning over the municipal electric distributing system to the Oklahoma Power Company, Okmulgee, which now supplies energy for the system.

WALTERS, OKLA.—The Southwestern Light & Power Company, McAlester, which is erecting a transmission lines from Lawton, plans to install a local substation for commercial service. The company is reported to be planning additions in the transmission system in this section.

CANADIAN, TEX.—The Council contemplates extensions and improvements in the municipal lighting system, including additional lines in new territory, to cost about $65,000.

Pacific and Mountain States

KIRKLAND, WASH. — Arrangements have been made by the Council with the Puget Sound Power & Light Company for the installation of an improved lighting system. The plans provide for thirty-six additional lamps in the business district and forty more in the residential section.

NEWPORT, WASH.—The Town Council has accepted the proposal of the Mountain States Power Company, Sandpoint, Idaho, to replace the present street-lighting system with incandescent lamps.

PORT ANGELES, WASH.—A resolution has been adopted by the City Council providing for the installation of an ornamental lighting system, maintained by underground wires, on Front and Laurel Streets.

SEATTLE, WASH.—The Hofius Steel & Equipment Company plans to install electric power equipment in its proposed plant on First Street, near Alaska Street, comprising a structural steel shop, frog and switch shops, locomotive engine house, etc.

YALE, WASH.—Plans are under way by the Northwestern Electric Company, Pittock Block, Portland, Ore., for the construction of a hydro-electric plant on the north fork of Lewis River, 2 miles south of here, to develop 60,000 hp. The work will include a dam 490 ft. long and 140 ft. high and a power house. The initial installation will include two 15,000-kw. turbo-generators and foundation for another unit of same capacity, and also a transmission line which will probably be erected in 1925. The cost of the entire project is estimated at $4,000,000.

ALHAMBRA, CAL.—The City Council has passed a resolution providing for the installation of an ornamental street-lighting system on Main Street.

EL CENTRO, CAL.—Bids will be received by the City Council, J. S. Loobourow, clerk, until Nov. 19, for two electric motor-driven centrifugal pumping units and two vertical electric pumps, complete with switchboard apparatus.

EMERYVILLE, CAL.—The Pacific Gas & Electric Company will soon begin work on foundations for its proposed local electrical and mechanical repair works to consist of six buildings, to cost about $500,000.

REDLANDS, CAL. — The City Trustees plan to install an ornamental street-lighting system on Highland Avenue, between Cedar Avenue and Cajon Street.

RIVERSIDE, CAL.—Permission has been asked by the Southern Sierras Power Company to issue $892,300 in bonds, the proceeds to be used for extensions and improvements to its system.

SIERRA CITY, CAL.—Plans have been prepared by R. Gillespie, engineer, Sierra City, for the construction of a power development on the Yuba River, and the erection of transmission lines in this section.

SAN FERNANDO, CAL.—Separate bids will be received by the United States Veterans' Bureau, Room 791, Arlington Building, Washington, D. C., until Dec. 9 for building construction, plumbing, heating and electrical work, electric elevators, etc., for administration, semi-ambulant building, general medical building, infirmary, officers', nurses' and attendants' quarters, laundry, storehouse, etc., and refrigerating plant at San Fernando.

FAIRFIELD, IDAHO.—The question of issuing $19,000 in bonds for the installation of a municipal electric light and power plant is under consideration by the village officials.

FILER, IDAHO.—The renewal of the street-lighting contract with the Idaho Power Company, Boise, provides for the installation of a new street-lighting system.

FALLON, NEV.—Bonds to the amount of $50,000 have been voted for the construction of a municipal electric generating plant.

Canada

COBALT, ONT.—The Northern Ontario Light & Power Company is planning to erect a transmission line from the Kirkland Lake Camp to the Argonaut Gold Mines, to cost about $35,000.

COCHRANE, ONT. — Arrangements are being made by the Abitibi Power & Paper Company for the construction of a hydro-electric plant, to develop about 30,000 hp., at Long Sault Rapids, about 10 miles north of Cochrane. The cost is estimated at about $4,000,000.

HARROW, ONT.—An extension of the transmission lines of the Hydro-Electric Power Commission of Ontario, Toronto, from Harrow to Colchester and Oxley is under consideration.

MANOTICK, ONT. — The Hydro-Electric Power Commission of Ontario, Toronto, is considering the erection of a 12-mile transmission line from Manotick toward Ottawa, to cost about $25,000.

WINDSOR, ONT.—Bids will be received by R. B. Braid, secretary Essex Border Utilities Commission, Heintzman Building, Windsor, until Nov. 26 for construction of a pumping station and for furnishing and installing equipment, including pumping station, pumping equipment, switchboard equipment, electric wiring and power connections, etc. Specifications, etc., can be obtained from J. Clark Keith, chief engineer, engineer of the commission, or from Gore, Nasmith & Storrie, consulting engineers, Confederation Building, Toronto.

SHERBROOKE, QUE.—A bylaw providing for an appropriation of $80,000 for the Electrical Department has been approved by the ratepayers.

VERDUN, QUE.—The Council contemplates an expenditure of $325,000 for extensions and improvements to the electric lighting system, waterworks and for street paving.

Electrical Patents

Announced by U. S. Patent Office

(Issued September 30, 1924)

1,509,965. THERMAL RELAY; Allis M. MacFarland, Pittsburgh, Pa. App. filed Aug. 17, 1920. Using a looped bimetallic member.

1,509,967. ELECTRICAL MEASURING INSTRUMENT; Paul MacGahan, Pittsburgh, Pa. App. filed Feb. 15, 1919. Power-factor meters.

1,509,971. INSULATED TERMINAL FOR ELECTRICAL APPARATUS; Ralph D. Mershon, New York, N. Y. App. filed Jan. 8, 1920. Transformers, storage batteries, electrolytic condensers, etc.

1,509,974. BRUSH-HOLDER ROCKER RING; Benjamin S. Moore, Wilkinsburg, Pa. App. filed Jan. 20, 1921. Railway motor construction.

1,509,976. RHEOSTAT; Norman E. North, Cantley, England. App. filed April 1, 1922. Of the starting type as used in electric traction.

1,509,984. CONTROL APPARATUS; Karl A. Simmon, Edgewood Park, Pa., and Harry R. Meyer, Wilkinsburg, Pa. App. filed March 23, 1920.

1,509,985. ACCELERATING SYSTEM FOR INDUCTION MOTORS; Joseph Slepian, Wilkinsburg, Pa. App. filed Nov. 28, 1919. Polyphase type deriving energy from a single-phase line through an intermediate dynamo-electric machine of the phase-converter type.

1,509,987. VARIABLE-RESISTANCE DEVICE; Lee Sutherlin, East Pittsburgh, Pa. App. filed Sept. 27, 1922. Grid-leak devices.

1,509,989. AUTOMATIC CUT-OUT FOR ELECTRIC FLATIRONS; Frank Thornton, Jr., Mansfield, Ohio. App. filed Nov. 29, 1921.

1,509,990. TRANSFER SWITCH; Ted G. Von Hoorn, Turtle Creek, Pa. App. filed June 30, 1923.

1,509,992. ELECTRODE OR GRID FOR STORAGE BATTERIES; James M. Allen, St. Louis, Mo. App. filed Oct. 6, 1920.

1,510,032. AUTOMOBILE SIGNAL; Charles F. Bliss, Olive, Cal. App. filed Feb. 8, 1922. Direction signal.

1,510,064. ELECTRICAL SWITCH; Frank E. Kloss, Milwaukee, Wis. App. filed Dec. 27, 1921. Tumbler switch.

1,510,078. WELDING AND FORGING DIE; Preston M. Hall, Swampscott, Mass. App. filed Jan. 20, 1922.

1,510,087. WASHING MACHINE; Thomas L. Jones and Henry J. Gillman, Belleville, Ill. App. filed Nov. 12, 1921.

1,510,092. MEANS FOR FIXING TRANSFORMERS IN THEIR OIL BOXES; Emil Lapp, Baden, Switzerland. App. filed April 2, 1919.

1,510,119. SWITCH HANDLE; Nils J. A. Wahlberg, Wilkinsburg, Pa. App. filed Jan. 6, 1921.

1,510,122. ELECTRIC SWITCH; Herbert I. Washburn, Magnolia, N. J. App. filed April 9, 1921. Totally inclosed contacts.

1,510,124. MULTI-OFFICE TELEPHONE SYSTEM; John Wicks, Chicago, Ill. App. filed Nov. 15, 1919. For systems going through a period of transition from manual to automatic operation.

1,510,125. REGULATING CONDUCTOR FOR ELECTRIC HEATERS; Watson H. Woodford, Bridgeport, Conn. App. filed Aug. 11, 1920. As electric irons, soldering irons, etc.

1,510,127. DRY CELL; Victor Yngve, South Orange, N. J. App. filed Nov. 14, 1923.

1,510,130. ELECTRIC LAMP STAND; Alexander Aronson, Newark, N. J. App. filed Oct. 11, 1922. Of the candlestick or like movable type.

1,510,134. ELECTRODE FOR ELECTROMETALLURGICAL FURNACES; Bartley E. Broadwell, Niagara Falls, N. Y. App. filed Oct. 19, 1922.

1,510,138. ELECTRIC VIBRATOR; George De Cairos-Rego, Sydney, New South Wales, Australia. App. filed April 27, 1921. Electromagnet type.

1,510,166. SPARK INTENSIFIER; Monroe Van Leuven, Redlands, Cal. App. filed April 1, 1922. For ignition system of internal-combustion engine.

1,510,169. CONTROL SYSTEM FOR COMPRESSORS AND THE LIKE; Burton S. Aikman, Milwaukee, Wis. App. filed May 21, 1917. Automatically effects the stopping and starting of the motor and the loading and unloading of the compressor.

1,510,172. MANUFACTURE OF MANGANESE-PEROXIDE ANODES; Martin Hosenfeld, Berlin-Charlottenburg, Germany. App. filed Sept. 14, 1923.

1,510,173. MANGANESE-PEROXIDE ANODE; Martin Hosenfeld, Berlin-Charlottenburg, Germany. App. filed Sept. 14, 1923. For electrolytic purposes.

1,510,184. STORAGE-BATTERY SUPPORT; John M. Manning, Friendship, Tenn. App. filed Aug. 16, 1921. To protect against vibration where used in motor vehicles, etc.

1,510,188. DIRECTION INDICATOR FOR AUTOMOBILES; Frank A. Mattke, Vernon, Cal. App. filed Nov. 26, 1921.

1,510,197. METHOD OF AND MACHINE FOR ELECTRIC WELDING; Michael B. Ryan, Milford, Conn. App. filed Aug. 8, 1923.

1,510,227. CUT-OUT FOR ELECTRICAL CIRCUITS; Ernest H. Jacobs, Chicago, Ill. App. filed March 21, 1921. Fused.

1,510,230. LIGHT FOR CHRISTMAS TREES AND THE LIKE; John Johnston, Chicago, Ill. App. filed Jan. 28, 1924. Cluster type.

1,510,247. ELECTRIC SOCKET PLUG; William J. Smith, Waterbury, Conn. App. filed May 15, 1922. Can be pushed into the usual threaded lamp socket.

1,510,263. CENTRIFUGAL STARTING SWITCH; Mark A. Defibaugh and Ralph J. Thieman, Battle Creek, Mich. App. filed Nov. 28, 1921.

1,510,270. SWITCH MECHANISM; David D. Gordon, Chicago, Ill. App. filed April 11, 1921. Push-button type.

1,510,341. ELECTRICAL APPARATUS; John A. Proctor, Lexington, Mass. App. filed June 4, 1921. For use in high-potential work such as in radio transmitters and receivers and in power-factor work.

1,510,343. SHIP PROPULSION; Louis Rask, Schenectady, N. Y. App. filed June 14, 1923. Variable-speed propeller motors supplied with current from a.c. generators driven by steam turbines.

1,510,350. FUSE BOX; George B. Thomas, Bridgeport, Conn. App. filed Oct. 25, 1920.

1,510,364. ELECTRIC BATTERY WITH AN ABSORBED LIQUID; Gustave Weissmann, Paris, France. App. filed May 16, 1922. Dry type.

1,510,383. ELECTRIC TRACTION SYSTEM; George L. Campbell, Philadelphia, Pa. App. filed Sept. 28, 1920. Surface contact system of the intermittent or sectional conductor type.

1,510,384. THERMO-CONTROLLED ELECTRIC DEVICE; Dionisio C. Castellanos, San Quentin, Cal. App. filed Feb. 9, 1923.

1,510,387. REEL; John G. Cook, Brooklyn, N. Y. App. filed March 18, 1919. For flexible conductor; particularly adapted for conductors for telephones used in automobiles.

1,510,409. SAFETY DEVICE FOR ELECTRIC COOKING AND HEATING DEVICES; Heinrich Maybaum, Sundern, Germany. App. filed March 29, 1922. Safety circuit breaker.

1,510,424. X-RAY-FILM CARRIER; Sinclair Tousey, New York, N. Y. App. filed Feb. 10, 1919.

1,510,437. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; Jacques Bohli, Solothurn, Switzerland. App. filed April 1, 1924.

(Issued October 7, 1924)

15,924 (reissue). WIRELESS REPEATER SYSTEM; Elmer A. Sperry, Brooklyn, N. Y. App. filed March 12, 1920. As used in aërial ordnance control.

15,929 (reissue). ELECTRICAL PROTECTIVE DEVICE; Paul MacGahan, Pittsburgh, Pa. App. filed August 9, 1915. Using temperature as well as overload relays.

1,510,455. DIFFERENTIAL-CONTROL MAGNET; William W. Bucher, Chicago, Ill. App. filed March 20, 1919. Applicable to the initial control of isolated electric generating units.

1,510,476. TONE-AMPLIFYING APPARATUS FOR MUSICAL INSTRUMENTS; Fred C. Hammond, Charlestown, N. H. App. filed July 8, 1922. Using a microphone and an electrical amplifying circuit.

1,510,488. MULTIPLE-WAY SELECTOR SWITCH; Frank H. Madsen, Sydney, New South Wales, Australia. App. filed April 7, 1923.

1,510,489. LIGHTING FIXTURE; Myer M. Marks, Chicago, Ill. App. filed July 14, 1923.

1,510,515. FINDER LIGHT; Clement J. Werner and Joseph H. Smart, Dorchester, Mass. App. filed March 4, 1922. Combined light and mirror.

1,510,529. SHADE HOLDER FOR INCANDESCENT ELECTRIC LAMPS; Louis Simenowsky, Milwaukee, Wis. App. filed Aug. 14, 1922.

1,510,540. TIPLESS LAMP STEM; Albert Brann, East Orange, N. J. App. filed June 2, 1921. For incandescent electric lamps.

1,510,541. ELECTRODE; Charles L. Burdick, New York, N. Y. App. filed March 16, 1923. Insoluble anode for use in the electrodeposition of metals as copper.

1,510,553. SYSTEM FOR CONTROLLING AT A DISTANCE GUNS OR OTHER APPARATUS; Paul Kaminski, Berlin-Pankow, Germany. App. filed Jan. 27, 1921.

1,510,558. ELECTRIC CONDUCTOR; Reinhold Rudenberg, Berlin-Charlottenburg, Germany. App. filed May 11, 1917. As used in rotors, utilizing a flat metal tube subdivided into spiral strips.

1,510,587. ELECTRICAL CIRCUIT TRANSMITTER; John M. Diegel, Minneapolis, Minn. App. filed Dec. 6, 1920. For normally closed circuit.

1,510,601. TELLTALE ATTACHMENT FOR EXPLOSION ENGINES; John H. Mount, Atlantic Highlands, N. J. App. filed March 22, 1921. For short-circuiting spark plug.

1,510,617. ACCUMULATOR ELECTRODE; Emile Vare, Brussels, Belgium. App. filed Feb. 17, 1922.

1,510,624. ELECTRICAL POWER TRANSMISSION BY RADIATION; August J. Kloneck, New York, N. Y. App. filed March 31, 1920.

1,510,676. REPEATER CIRCUITS; Edgar D. Johnson, East Orange, N. J. App. filed Feb. 1, 1918. With two-way transmission.

1,510,698. REPEATING METHOD AND SYSTEM; Alexander M. Nicolson, New York, N. Y. App. filed March 18, 1918. As used on a telephone line.

1,510,731. LIGHTNING ARRESTER; Pearce P. Williams, Nutley, N. J. App. filed June 23, 1922. For use in radio sets.

1,510,741. ROTARY SPARK-GAP APPARATUS; Ernest G. Danielson, San Francisco, Cal. App. filed Oct. 30, 1919. For use in radio signaling systems.

1,510,780. ELECTRICAL MEASUREMENT; Herbert P. Holinagel, Brookline, Mass. App. filed May 8, 1918. Of X-rays of high intensity.

1,510,789. ELECTRIC WIRE CLEAT; John Levandofsky, Buchtel, Ohio. App. filed March 22, 1923. With wires clamped in position and readily removable independently.

1,510,792. METHOD OF AND MEANS FOR DETERMINING PHASE DIFFERENCE; Ernest Merritt, Ithaca, N. Y. App. filed July 1, 1921. At relatively high frequencies.

1,510,796. ELECTRIC HEATER; Charles E. Patterson, Los Angeles, Cal. App. filed Oct. 9, 1923. Through which the air may freely circulate; for household use.

1,500,799. LOOP AËRIAL; James H. Rogers, Hyattsville, Md. App. filed July 12, 1923. With conductors in the surface of a tore.

1,510,845. RUNNING-LIGHT SYSTEM AND BOARD; John W. Haywood, New York, N. Y. App. filed Aug. 22, 1923. For ships.

1,510,847. CHRISTMAS-TREE LIGHTING; Homer D. Holler, Leonia, N. J. App. filed April 18, 1922. Lamps in series with resistances connected across the terminals of each lamp.

1,510,859. INDUCTANCE-COIL MOUNTING; Louis G. Pacent, Winfield, N. Y. App. filed July 24, 1922. For use in radio.

1,510,870. ELECTRIC GRILL; Courtland R. Steenrod, Dayton, Ohio. App. filed Feb. 12, 1923. Small household type.

1,510,876. VARIOMETER; Robert L. Walker, Atlanta, Ga. App. filed Jan. 26, 1924.

1,510,878. ELEVATOR-HATCHWAY DOOR LOCK; William J. Wigmore, Oakland, Cal. App. filed July 16, 1923.

1,510,897. COMBINATION WATCHMAN, PATROL, AND FIRE-ALARM TRANSMITTER; James D. Nelson, Cincinnati, Ohio. App. filed Oct. 8, 1917.

1,510,901. MAGNETO CIRCUIT BREAKER; Edward B. Nowosielski, Bloomfield, N. J. App. filed Nov. 25, 1921.

1,510,932. TUBE MACHINE; John F. Gail, Evanston, Ill. App. filed Nov. 8, 1920. For producing metal tubing or pipes having longitudinal welded joints or seams from sheets or strips of metal.

1,510,945. RADIO RECEIVING SYSTEM; Earle B. Lewis, Waterbury, Conn. App. filed Aug. 8, 1923. Using an audion detector.

1,510,946. MAGNETO DISTRIBUTOR AND BEARING THEREFOR; Albion D. T. Libby, East Ohange, N. J. App. filed Feb. 11, 1922.

1,510,977. DETACHABLE COUPLING FOR ELECTRIC WIRES; William T. Clark, Milwaukee, Wis. App. filed April 11, 1921.

1,510,985. TRANSMISSION REGULATION; Lloyd Espenschied, Hollis, N. Y. App. filed May 4, 1922. For multiplex signaling circuits.

1,511,013. EQUALIZATION OF CARRIER TRANSMISSIONS; Herman A. Affel, Brooklyn, N. Y. App. filed July 8, 1920.

1,511,014, 1,511,015. TRANSMISSION REGULATION; Herman A. Affel, Brooklyn, N. Y. App. filed May 4, 1922. For multiplex signaling circuits.

1,511,022. ELECTRIC BRAKE; Francis W. Borkes, Cleveland, Ohio. App. filed July 1, 1922. As used on elevators.